Santa Clara Valley
Water District

San Francisquito Creek Levee Project

Footbridge to 1400 feet Upstream of Highway 101

ENGINEER'S REPORT

April 2002

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Santa Clara Valley
Water District

May 10, 2002

LETTER OF REVISION NO. 1
TO ENGINEER'S REPORT FOR THE SAN FRANCISQUITO CREEK LEVEE PROJECT
PROJECT NO. 102806

Notice is given that the following revisions are hereinafter incorporated as part of the Engineer's Report for the San Francisquito Creek Levee Project, dated April 2002.

REVISION

Change the following:

Page 22, 3rd paragraph from the top, "Change the number 1 to superscript.

It has been found that in tidal slough areas, sediments are typically deposited to the elevation of Mean Higher High ~~Water1~~ Water[1].

Change the following:

Page 45, 4th paragraph from the top, "Delete Measure B" and incorporate the wording "the Lower Peninsula Watershed Funds."

The District will fund work through existing tax revenues and ~~Measure B revenues (Clean, Safe Creeks Program)~~ the Lower Peninsula Watershed Funds.

Change the following:

Page 28, last paragraph, "Change 0.5 foot to 0.7 foot." See prior paragraph on the same page that indicated it needs to be 0.7 foot.

This will entail adding a minimum of about ~~0.5 feet~~ 0.7 feet up to a maximum of about 2.6 feet of fill material to the levee top.

THIS LETTER OF REVISION SHALL BE ATTACHED TO AND FORM A PART OF THE ENGINEER'S REPORT FOR THE CONSTRUCTION OF THE SAN FRANCISQUITO LEVEE PROJECT (FROM PEDESTRIAN FOOTBRIDGE TO 1400 FEET UPSTREAM OF WEST BAYSHORE)

C. Liang Lee
Senior Project Manager
Capital Program Services Division

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SANTA CLARA VALLEY WATER DISTRICT

SAN FRANCISQUITO CREEK LEVEE PROJECT

FOOTBRIDGE TO 1400 FEET UPSTREAM OF HIGHWAY 101

VOLUME ONE

ENGINEER'S REPORT

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March 2002

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SECTION 1

1.1 INTRODUCTION

This report presents the results of a planning study investigation to examine alternatives that would provide additional flood protection to the area of San Francisquito Creek downstream of Highway 101. This study was initiated to provide supplemental flood protection to the areas downstream of Highway 101 until a comprehensive multiyear planning study could be completed covering the entire San Francisquito Creek watershed. This planning-level investigation was conducted at the request of the San Francisquito Creek Joint Powers Authority (JPA). The JPA represents the interests of the cities of Menlo Park, Palo Alto and East Palo Alto, the County of San Mateo and the Santa Clara Valley Water District (District). Associate members include the Coordinated Resources Management and Planning Group for San Francisquito Creek (CRMP) and Stanford University.

In September 2000, the JPA requested that the District lead the effort to restore the levees downstream of Highway 101 to their 1958 elevations. The primary objectives for the project, as requested by the JPA were to 1) Partially restore the original level of flood protection to the area downstream of Highway 101 by restoring the levees to their 1958 elevations, and 2) Ensure that construction of the project can occur by Winter, 2001/2002. These objectives were derived from post-flood coordination efforts. It was the understanding at the time that this project may be possible because it was a maintenance project, not a new capital improvement and it had a very specific focus with no apparent insurmountable obstacle. **Figure 1** presents a Project Location and Vicinity Map.

During the planning and design phase of a levee restoration project, several questions were raised by JPA member agencies and members of the public about the feasibility of alternative ideas that would provide increased flood protection to the area downstream of Highway 101. In the interest of documenting the material studied in response to these questions, this report outlines the work done to determine the feasibility of meeting the apparent intent of the broader original objectives with alternatives other than restoring the levees downstream of Highway 101 to their 1958 elevations.

1.2 BACKGROUND

The channel and earth levees downstream of Highway 101 were constructed in 1958 in a cooperative effort between San Mateo County (SMC) and the Santa Clara Valley Water District (SCVWD) to provide flood protection. The levees are no longer at their 1958 As-Built elevations due to land subsidence, settlement and erosion, which have caused a reduction in the elevation of the levee top of between 0.5 and 2.6 feet along the length of both sides of the creek downstream of Highway 101.

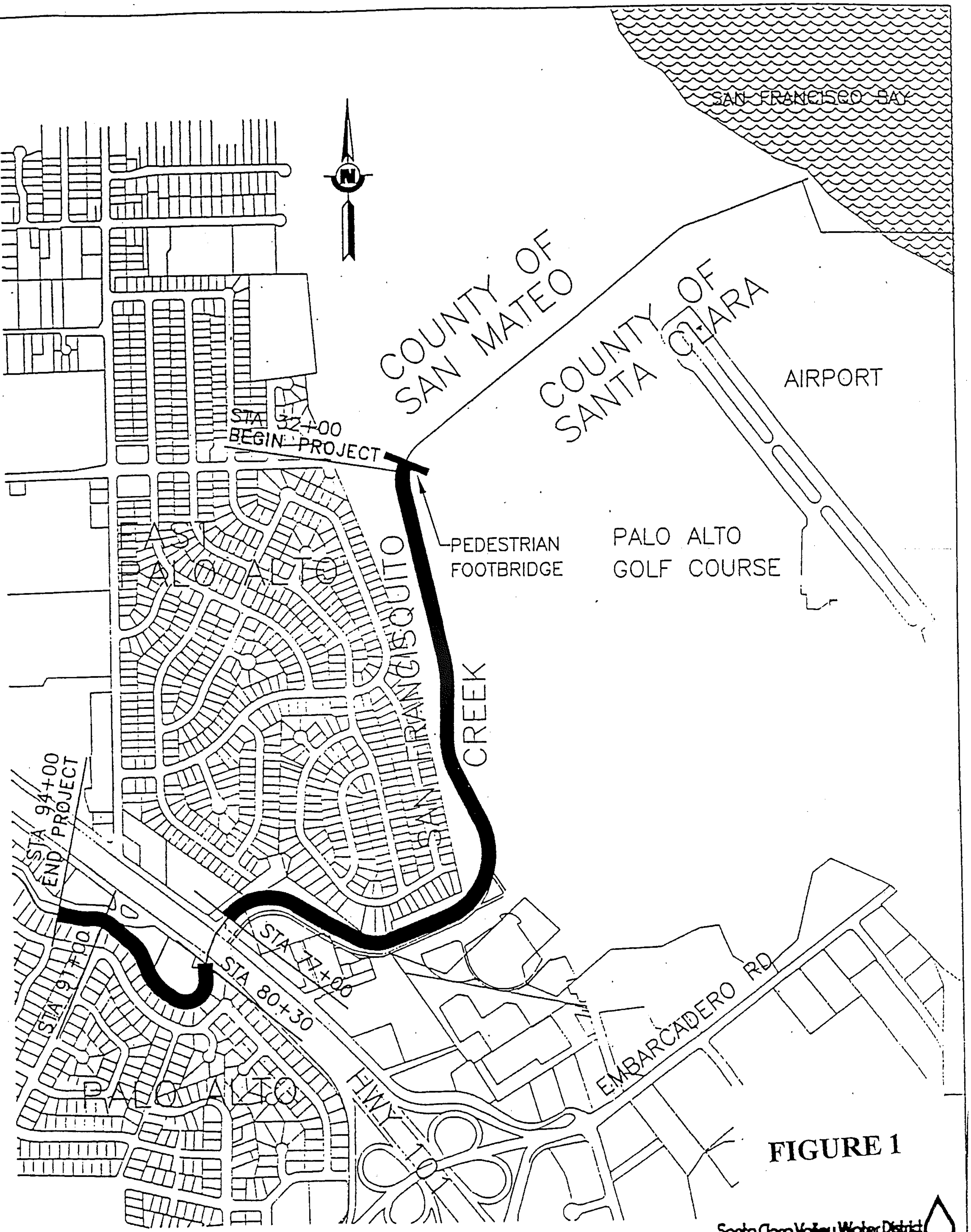


FIGURE 1

SAN FRANCISQUITO CREEK LEVEE RESTORATION PROJECT VICINITY

The channel downstream of Highway 101 has also experienced significant sedimentation. The sediment, most of which has been deposited by tidal inflows, restricts the conveyance capacity of the channel, and contributes to its loss of capacity compared to the design of the 1958 project. Originally designed to convey a flow of 7,100 cubic feet per second (cfs) with 1.5 to 2 feet of freeboard, the channel can convey only about 3,600 to 4,000 cfs to the top-of-bank under existing conditions.

In February of 1998, the project area experienced overbanking in several locations at the flow of record, reported as 7,200 cfs at the USGS gaging station at the Stanford Golf course, approximately 8 miles upstream of the project site. There was significant overbanking upstream of the project site. More recently, in February 2000, the project area sustained top-of-bank flow, without overbanking, at a flow of approximately 3,900 cfs as measured at the USGS gaging station (unpublished data).

1.3 SETTING

San Francisquito Creek is located on the boundary between Santa Clara County and San Mateo County. Most of the approximately 42 square mile watershed is located in San Mateo County with Los Trancos and San Francisquito Creeks forming the county line.

The project reach is approximately 6,800 feet long, extending from an existing pedestrian bridge, which is approximately 3,000 feet upstream of the San Francisco Bay, to approximately 1,400 feet upstream of Highway 101.

Downstream of Highway 101 the creek is contained within earthen levees and has a bottom width of roughly 50 feet, with side slopes that vary between 1:1 and 3:1. There is a maintenance road on top of the levee on both sides of the creek for the length of the project, downstream of Highway 101.

Upstream of Highway 101, the sideslopes are protected by sacked concrete. On the Santa Clara County side of the creek there is a sacked concrete wall. The San Mateo County side of the creek has a concrete gravity wall along much of the creek in the project vicinity, except for an area of about 1,100 linear feet immediately upstream of the West Bayshore Road bridge, which has earth fill placed to several feet above the previously existing sacked concrete slope protection. This fill was placed in 2000 as part of a residential development to create a construction pad above the 100-year water surface elevation. The sacked walls, gravity wall and slope protection were placed as part of 1958 and 1969 interim flood protection projects sponsored by the SCVWD and the San Mateo County Flood Control District (SMCFlood).

Access to the floodwalls upstream of Highway 101 is restricted; on the Santa Clara County side of the creek, the SCVWD has a narrow easement that extends from the center of the channel to the top of bank, at the approximate location of the existing floodwall. Several of the residences have extended their backyards and/or fences until they nearly abut the existing floodwall, making access from the top of the bank difficult. On the San Mateo County side of the creek, the existing gravity wall is directly accessible from Woodland Creek Road. The 1,000 linear feet immediately upstream of the West Bayshore Road Bridge abut the property of the new Woodland Creek residential development. The development has increased the height of the bank with fill, so that the existing easement of the San Mateo County Flood Control District now extends only partially up the bank, rather than to the top-of-bank, as originally laid out in 1969. Construction access and maintenance easement for this property will also require negotiation if it is included in the project area.

As partial mitigation for constricting high flows and increasing the water surface in the vicinity, a weir was proposed to be constructed at the upstream boundary of the site (approximately station 91+00), which would allow a portion of very high flows to exit the channel and flow around the development and return to the channel just upstream of the Highway 101/ West Bayshore Road bridge.

1.4 PROJECT SPONSOR:

San Francisquito Creek is the boundary line for two counties and three cities. The Joint Powers Authority (JPA) was formed as a cooperative effort by the five corresponding public agencies to provide planning, engineering and funding for needed San Francisquito flood control projects. The JPA is an umbrella organization that may also address any other creek related issues.

The JPA member agencies include the following:

- City of Palo Alto (CPA)
- City of East Palo Alto (CEPA)
- City of Menlo Park (CMP)
- San Mateo County (SMC)
- Santa Clara Valley Water District (District)

The JPA Board has negotiated with the District to be the responsible agency for the project. This District will generate plans and specifications for the entire project. SMC is responsible for the CEQA work related to the entire project. Appendix A is the Agreement between JPA members for Cost Sharing and Responsibilities for this project.

1.5 PUBLIC OUTREACH

Staff has been working closely with the other member agencies to reach out to the community. Three public meetings were held by the District to discuss the project with the residents in Palo Alto. One meeting was sponsored by JPA with all member agencies taking part to discuss the entire project in both counties. Most residents responded favorably to the project, although some are reluctant to dedicate easements to the District.

SECTION 2

HYDROLOGY

The existing capacity of the creek downstream of Highway 101 is approximately 3,600 to the top-of-bank, under a one percent tide (8 feet NGVD). This flow corresponds to approximately a 4 to 6-year return period. The capacity estimate is based on the event of February 13, 2000, which was gaged at the USGS gaging station at the Stanford Golf Course, approximately 8 miles upstream of the project site. The preliminary (unpublished) data reported by the USGS indicated a flow of 3,900 cfs at the golf course, at a tide of approximately one foot NGVD. No overbanking was reported in the project vicinity at that event.

The Federal Emergency Management Agency (FEMA) publishes an existing 1% flow for the project area (downstream of the Chaucer Street bridge) of 6,000 cfs. This figure is based on substantial overbanking occurring upstream of the project site, which significantly reduces the in-creek flow that arrives at the project reach. FEMA publishes the same flow of 6,000 cfs as the 2% flow (50-year event). This is also based on substantial overbanking occurring upstream of the project site. A flow of 6,000 cfs would have a return period of approximately 17 years, but would not be exceeded at the project site more than once in 100 years on average.

Upstream of the project site, FEMA reports a 1% flow for the creek of 8,070 cfs at the USGS gage, increasing to 8,330 cfs upstream of Middlefield road, at which point overbanking reduces the in-creek flow to areas further downstream. **Table 1** is excerpted from the FEMA Flood Insurance Study for Palo Alto, 1999. It lists the flows at different locations along the creek for standard recurrence intervals of 10-year, 50-year, 100-year and 500-year. The reported values account for overbanking at several locations, therefore do not represent the ultimate design flows, if all water were to be contained in the creek. It is clear that if the upstream portion of the creek were to be improved to convey the 1% flow, then substantially more flow would reach the project site than under existing conditions.

This proposed levee restoration work is not designed to provide protection to the 1% or 2% event, either under existing conditions or under the possibility of upstream improvements. It is designed only to recreate a former condition (the 1958 levee elevations), not to convey a particular flow. The proposed project does not meet FEMA guidelines for removing area from a mapped floodplain.

TABLE 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second)			
		10-Year	50-Year	100- Year	500- Year
San Francisquito Creek					
At U.S. Geological Survey Gage	37.1	4,050	6,700	7,860	10,500
Near Pasteur Drive	39.1	4,200	6,850	8,070	10,400
At Alma Street	40.6	4,350	7,050	8,280	9,850[1]
Upstream of Middlefield Road	41.6	4,350	7,100	8,330	9,850[1]
Downsteam of Middlefield Road	41.6	4,350	6,350[1]	6,690[1]	7,410[1]
Downstream of Chaucer Street	41.6	4,350	6,000[1]	6,000[1]	6,200[1]
San Francisquito Creek-Overflow					
At Middlefield Road	---[2]	---[2]	---[2]	752	---[2]
At Chaucer Street	---[2]	---[2]	---[2]	563	---[2]
Combined Middlefield & Chaucer Overflows	---[2]	---[2]	---[2]	1,080	---[2]

[1] Reduced or Constant Flow Value Due to Capacity Restrictions

[2] Data Not Computed

Ref: Federal Emergency Management Agency (FEMA) June 2, 1999
Flood Insurance Study for City of Palo Alto, CA
Community Number #060348

SECTION 3

DESCRIPTION OF ALTERNATIVES

This study was initiated to provide supplemental flood protection to the areas downstream of Highway 101 until a comprehensive multiyear planning study could be completed covering the entire San Francisquito Creek watershed. Because of channel capacity restrictions upstream of the project area, only approximately 6,000 cfs will flow to the project reach during a one percent event (per FEMA 1999). This is less than the future 1% design flow rate of 9,300 cfs (estimated SCVWD). When comparing flows for the project reach, 6,000 cfs was used as the existing one percent flow, since the upstream restriction will not be resolved prior to the ten to fifteen year planning horizon for this project. The existing capacity of the reach downstream of Highway 101 is 3,600 cfs.

The primary objectives for the project, as requested by the JPA were to 1) Partially restore the original level of flood protection to the area downstream of Highway 101 by restoring the levees to their 1958 elevations, and 2) Ensure that construction of the project can occur by Winter, 2001/2002. These objectives were derived from post-flood coordination efforts. It was the understanding at the time that this project may be possible because it was a maintenance project, not new capital improvement and it had a very specific focus with no apparent insurmountable obstacle. During the planning and design phase of a levee restoration project, several questions were raised by JPA member agencies and members of the public about the feasibility of alternative ideas that would provide increased flood protection to the area downstream of Highway 101. In the interest of documenting the material studied in response to these questions, this report outlines the work done to determine the feasibility of meeting the apparent intent of the broader original objectives with alternatives other than restoring the levees downstream of Highway 101 to their 1958 elevations.

Numerous alternatives were investigated which could provide some enhanced flood protection in the short term.

Alternative 1................	No Project
Alternative 2................	Restore Levees to 1958 Elevations
Alternative 2 A........	Overflow Weir at Golf Course
Alternative 3...............	Dredge Sediment
Alternative 4...............	Combined Dredge Sediment with Restore Levees
Alternative 5...............	Lower North Levee at Wildlife Refuge
Alternative 6...............	Increase Levee Height to Less Than 1958 As-Built

A discussion of each alternative, its benefits and costs, follows.

3.1 ALTERNATIVE 1: NO PROJECT

The No Project alternative would continue the existing maintenance program, which includes vegetation control on the existing levee roads and erosion repairs on an as-needed basis. The existing maintenance program does not include sediment removal other than a short reach immediately downstream of the Bayshore frontage road (Highway 101) bridge. This alternative would not provide additional flood protection to the area downstream of Highway 101.

Under existing conditions, the project reach can convey approximately 3,600 to 4,000 cfs to the top-of-bank, with no freeboard. This corresponds to approximately a 4 to 6-year return period.

Because existing maintenance practices include periodic sediment clearing in the reach immediately adjacent to Highway 101, as well as occasional levee erosion repair, there would be environmental review requirements associated with routine maintenance work. Permits or authorizations would be required from the U.S. Army Corps of Engineers, the Regional Water Quality Control Board, and the California Department of Fish and Game. The District's Multi-Year Stream Maintenance Program covers the routine sediment removal immediately downstream of Highway 101. If multi-year permits are acquired under this Program, environmental compliance for this particular aspect of San Francisquito Creek maintenance would be considerably more simple.

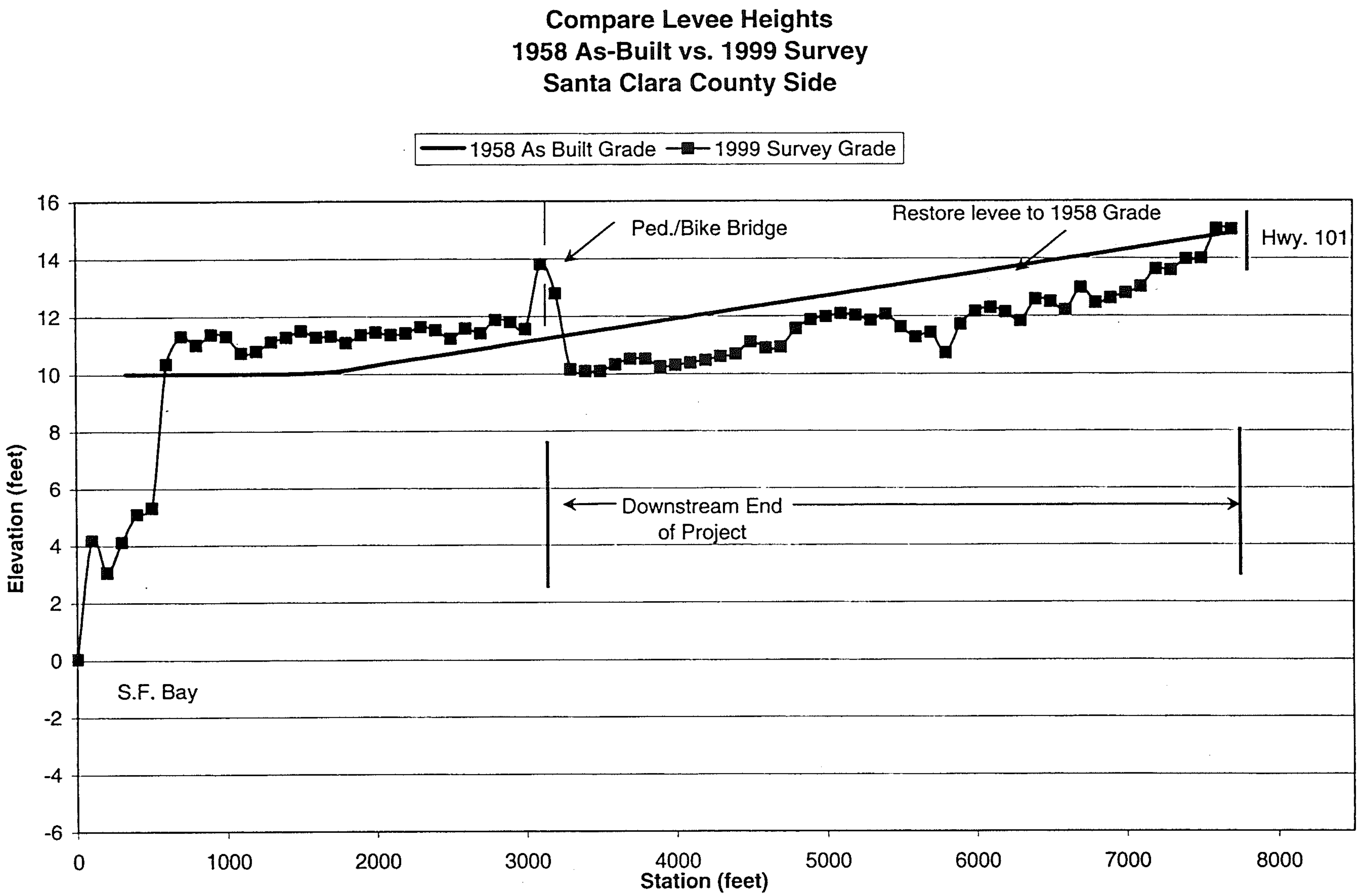
Under any chosen alternative, maintenance practices would continue. Therefore, while this alternative does not meet the project objectives of increasing flood protection OR being constructed by Winter 2001/2002, existing maintenance practices will continue on a separate track from this project.

3.2 ALTERNATIVE 2: RESTORE LEVEES TO THEIR ORIGINAL 1958 CONSTRUCTED ELEVATION

This alternative was selected for study by the JPA in September 2000.

Levee work would be designed to restore the top of levee elevations along both sides of the creek to the 1958 as-constructed elevations. **Figures 2 and 3** illustrate schematically the work on each side of the creek required to match 1958 levee elevations. The figures present a comparison between the existing levee surface as surveyed in 1999 and the 1958 as-constructed levee grade line. Where the existing levee is below the 1958 levee, it will be raised to match the 1958 elevation. This will entail adding a minimum of about 0.5 feet up to a maximum of about 2.6 feet of fill material to the levee top.

Downstream of Highway 101, the earth levees would be raised with a 2:1 side slope, which would result in expansion of the levee footprint on one side. To achieve a 2:1 side slope while maintaining adequate top width for a maintenance road, one side of the levee would be completely cleared of vegetation and the levee would be overbuilt on that side.



Alternative 2: Restore Levees to 1958 Elevation

FIGURE 2

Compare Levee Heights
1958 As-Built vs. 1999 Survey
San Mateo County Side

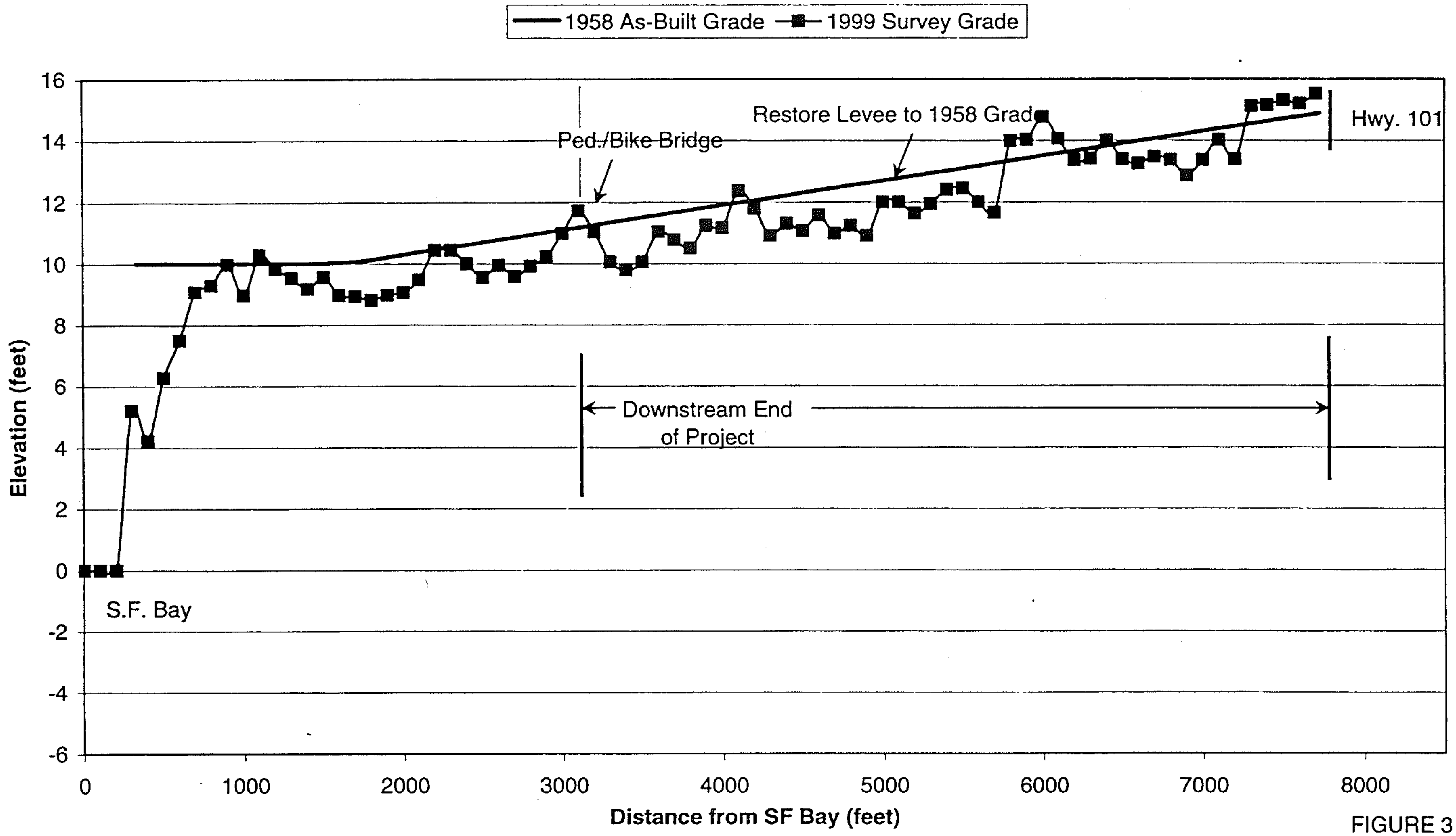


FIGURE 3

Alternative 2: Restore Levees to 1958

Figure 4 provides a schematic diagram of each of the two construction methods that will be used to add levee height downstream of Highway 101; 1) compacted earth fill, which expands the levee footprint and requires clearing of one side of the levee, and 2) reinforced earth, which can add height to the levee without expanding the levee footprint.

In general, the Santa Clara County side of the creek, downstream of Highway 101 will use the reinforced earth technique for the length of the project. On the San Mateo County side of the creek, most of the project will use the traditional compacted earth levee restoration technique, except in a few areas where wetlands have been delineated on both the inboard and outboard side of the creek, or where existing utilities require special attention.

No work is proposed downstream of the pedestrian bridge, Station 31+50. On the Palo Alto side of the creek, the existing levee top is above the 1958 elevations, so no work would be required in that area (**see Figure 2**). On the San Mateo County side of the creek, the levee abuts a portion of the Don Edwards National Wildlife Refuge, a sensitive area containing wetland species. The existing levee in that area, while in some places below the 1958 elevations, is at all places above the calculated water surface profile for the FEMA 1% flow of 6,000 cfs at the 1% tide of 8 feet (See **Figure 5**).

Hydraulic Impact Section

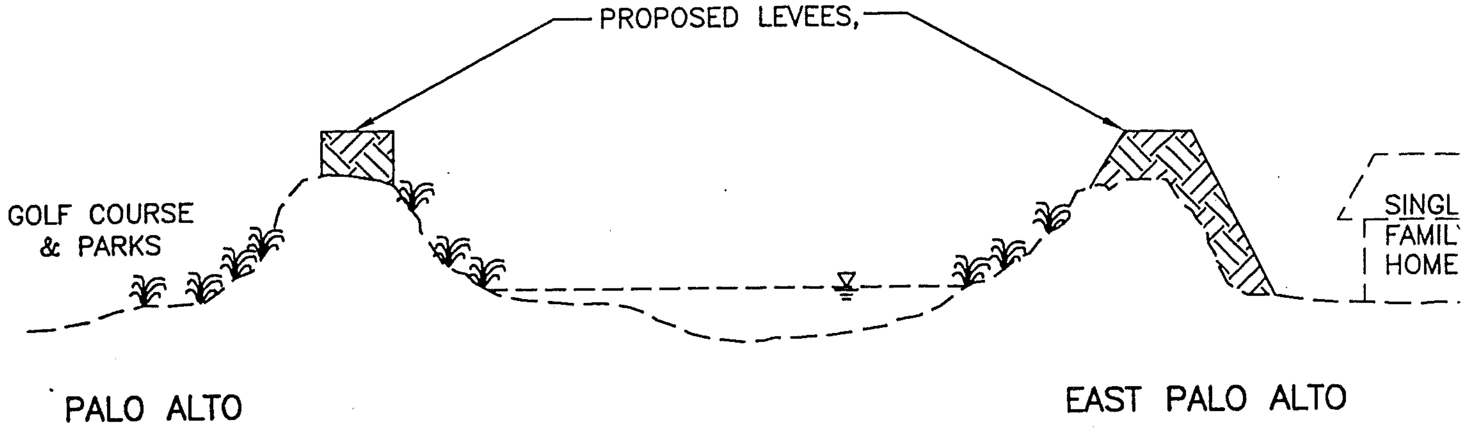
The existing capacity of the project reach is approximately 3,600 cfs to 4,000 cfs to the top of bank (no freeboard at this flow). This corresponds to approximately a 4 to 6-year return period. The restored levee will convey approximately 5,900 cfs, corresponding to approximately a 16-year return period. This flow would reach the top of bank in the area just downstream of Highway 101. The project would not provide protection to the 1% event, because it is designed to restore a previously constructed levee, not to convey a particular flow.

Restoration of the levees downstream of Highway 101 will result in an increased water surface elevation, due to the containment of additional flow, compared to what would be conveyed in the channel under existing conditions for flows above approximately 4,000 cfs.

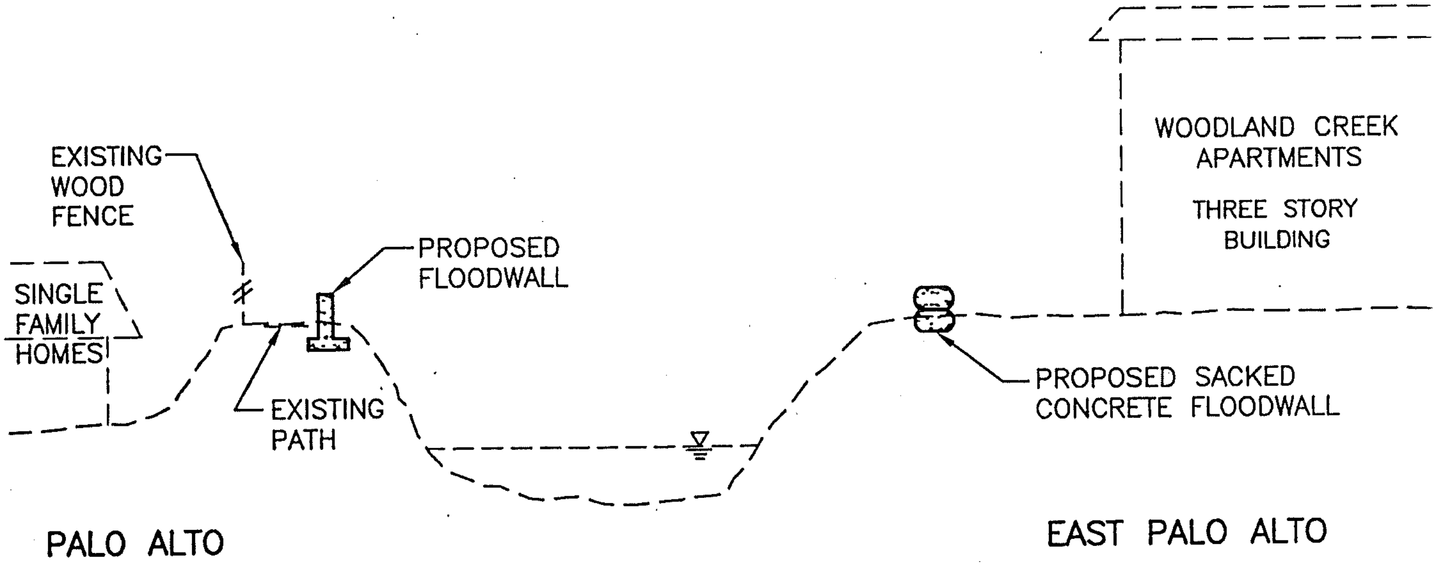
The increased water surface would not result in overbanking except for a length of about 14 feet of channel, on the San Mateo County side of the creek, immediately upstream of the West Bayshore bridge. In all other areas, the increased water surface elevation would reduce freeboard, but not induce flooding for the 1% event.

The preceding information is based on analyses provided by Northwest Hydraulics, Inc. Appendix C presents the data and summary memorandum provided by Northwest Hydraulics, Inc.

Hydraulic impacts in the form of loss of freeboard would be avoided by raising the wall on the Santa Clara County side and constructing a low wall on the San Mateo County



FOOTBRIDGE TO HWY 101
STA. 32+00 TO STA 78+00



U/S OF HWY 101
STA. 80+57 TO STA 91+00

FIGURE 4

DATE 3/22/02
DESIGN
DRAWN C. MENSING
CHECKED

Santa Clara Valley Water District

SAN FRANCISQUITO CREEK

SCALE N.T.S
SHEE

DWG FILE NAME: G:\dwgs\sdskproj\102804\DISPLAY\SECTIONS\SHT_1_3a.dwg

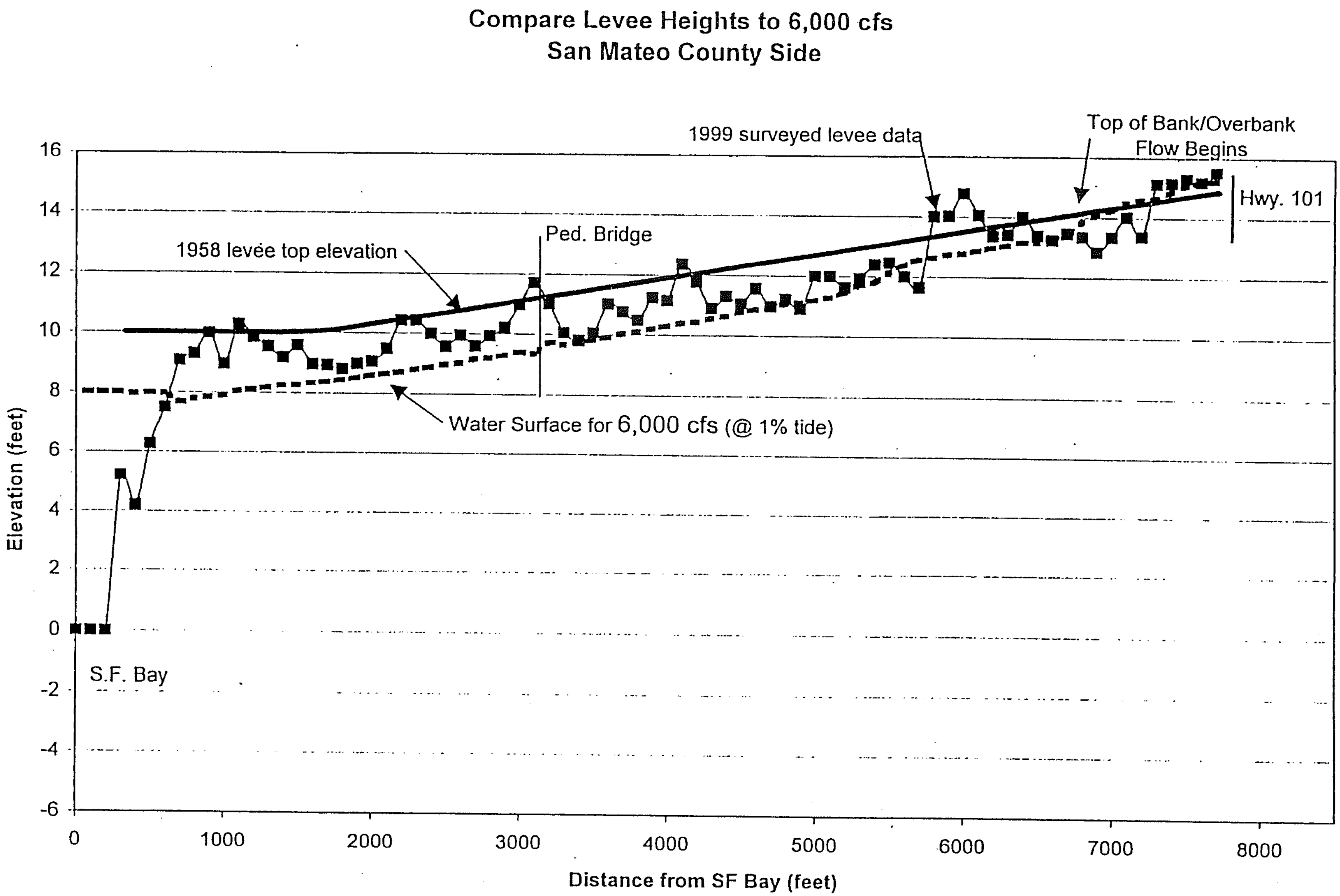

Compare Levee Heights to 6,000 cfs
San Mateo County Side
1999 surveyed levee data
Top of Bank/Overbank Flow Begins
Hwy. 101
Ped. Bridge
1958 levee top elevation
Water Surface for 6,000 cfs (@ 1% tide)
S.F. Bay
Elevation (feet)
16
14
12
10
8
6
4
2
0
-2
-4
-6
0
1000
2000
3000
4000
5000
6000
7000
8000
Distance from SF Bay (feet)

FIGURE 5

side, upstream of Highway 101. On each side of the creek, the wall would be raised by an amount equivalent to the maximum anticipated increase in water surface for the existing 1% flow conditions. The height of the walls will be increased less than one foot for a distance of approximately 1,800 feet upstream of Highway 101.

Downstream of the proposed project location, from the pedestrian bridge to the San Francisco Bay, the increased confined flow would result in an increased water surface compared to existing conditions at the 1% FEMA flow. The increase would be generally less than one-half foot. This flow would be contained by the existing levees, with freeboard. No additional levee work is proposed in the approximately 3,000 feet between the pedestrian bridge and the Bay because on the Santa Clara County side of the creek, the existing levee is higher than the 1958 plan elevations, and on the San Mateo County side of the creek, the levee abuts a portion of the Don Edwards National Wildlife Refuge. Construction impacts of raising the levee in that area would likely be more significant than the loss of freeboard resulting from the proposed project. A natural tidal wetland (the US Fish and Wildlife Refuge) is open to the Bay on the outboard side of the San Mateo County levee. This area would be inundated by Bay tides during extreme high tide events, but is not expected to be inundated by creek flow even during extreme high flow events (up to the 1% FEMA flow), because the existing levee would serve to separate the wetland from the creekflow.

Maintenance

Maintenance of the proposed levee restoration areas will be consistent with the SCVWD existing Baseline Maintenance Program for levees. This includes monitoring for erosion, seepage, caving or settlement; periodic vegetation control; monitoring for rodent damage; and maintaining the roads in serviceable condition. Environmental impacts from maintenance activities would be covered under the SCVWD's existing maintenance program. If additional environmental clearance were required for maintenance activities, they would be handled separately on a case-by-case basis. Appendix D presents the levee maintenance guidelines that would continue to be followed for San Francisquito Creek.

Environmental and Regulatory Considerations

This alternative has been designed to avoid impacts to wetlands and mature vegetation. All work would be accomplished outside of the channel, with Best Management Practices (BMPs) implemented to avoid potential impacts to the water quality of the creek. Although consultation would be required with the various environmental regulatory agencies, it is expected that the work as proposed could be accomplished without requiring permits.

Time to Implement

The planning, design and environmental (CEQA) work can be completed in time to have construction of this Alternative 2 scheduled for Summer 2002.

Costs

The construction cost for this Alternative 2 is estimated to be approximately $2 Million.

3.3 ALTERNATIVE 2 A: USE PALO ALTO GOLF COURSE AS DETENTION BASIN

Using the golf course as a temporary detention basin during very high flow events could provide hydraulic relief in the form of a lower water surface. This option was considered as possible mitigation for the increased water surface resulting from Alternative 2. Allowing water to overflow the levee into the golf course could lower the water surface, potentially reducing the hydraulic impacts upstream of Highway 101 (See description of Alternative 2, above). **Figure 6** shows schematically how such a weir might operate.

The golf course is approximately 150 acres.. A ring levee would be required around the course, to protect the adjacent low-lying areas from inundation during flood events. The detention basin would offer about 1,200 acre-feet of storage.

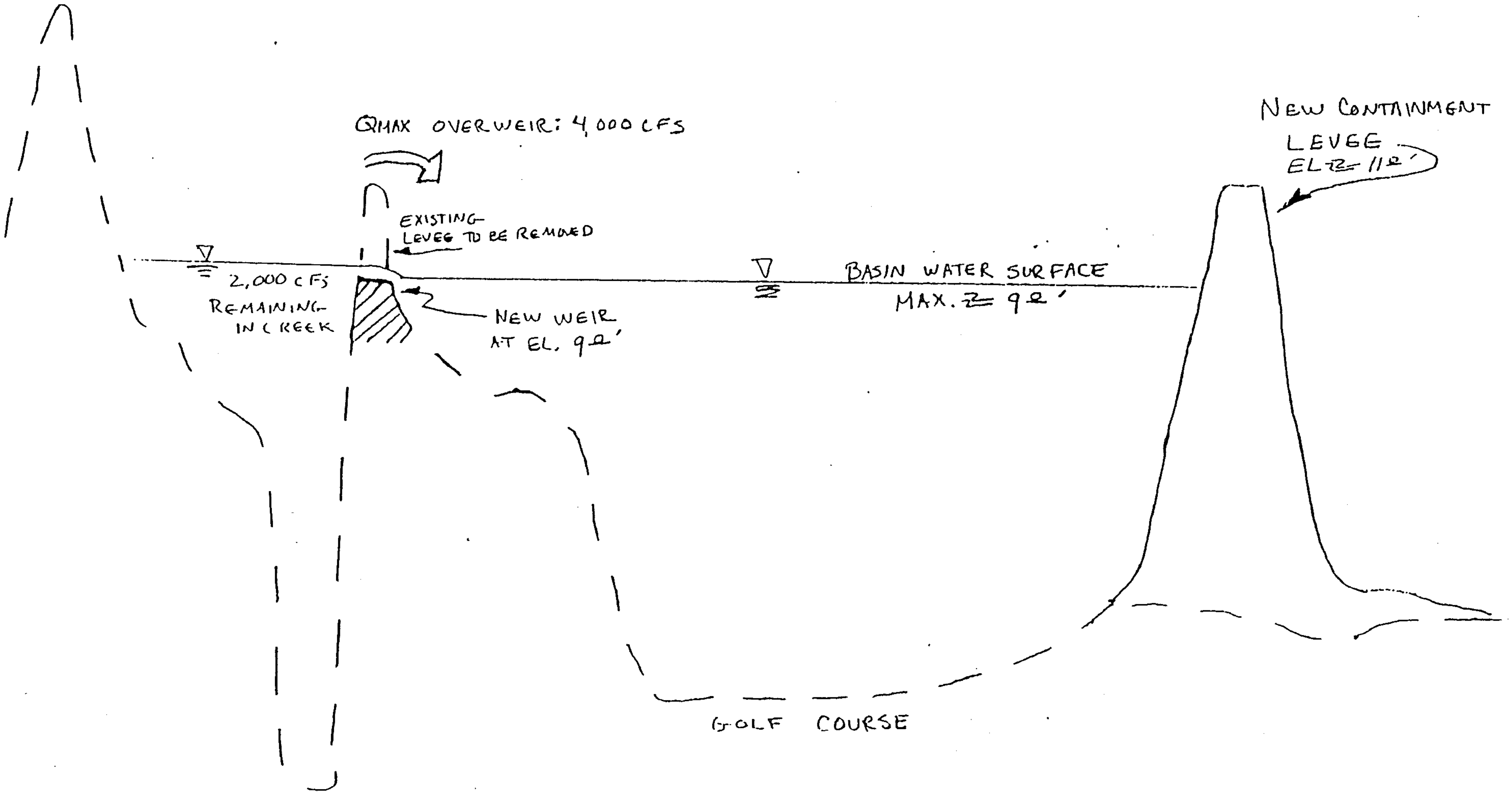
The maximum feasible amount of flow that could be diverted from the creek during a 6,000 cfs event would be approximately 4,000 cfs, leaving 2,000 cfs in the creek downstream of the diversion. Diverting more flow would not provide additional hydraulic relief because the water elevation in the creek would be tidally controlled at lower flows.

At the site of the overflow weir, a bridge structure would be required to provide continuous access along the maintenance road. A drainage system, either passive (pipes) or active (pumps and pipes) would be required to empty the storage basin after each event. Maintenance of the golf course following each inundation event would also be required.

Hydraulic Impact

To analyze for the most favorable conditions, a diversion of 4,000 cfs, and a diversion point of approximately Station 58+00, the upstream-most end of the golf course, were used. Diverting 4,000 cfs from the creek at the golf course would provide about 0.2 feet of hydraulic relief upstream of Highway 101.

Figure 7 illustrates the results of the analysis. The very thick line at the top represents the top of levee on the Santa Clara County side of the creek after being restored to the 1958 elevation (the proposed weir at the golf course is not shown). The thin water surface line shows the water surface for a starting flow of 6,000 cfs for "pre-existing conditions". That is, prior to either the existing Woodland Creek Apartments development or the proposed Levee Restoration Project. This water surface accounts for overbanking both upstream and downstream of Highway 101. The purpose of this Alternative is to match this "pre-existing" water surface upstream of Highway 101.


QMAX OVERWEIR: 4,000 CFS
EXISTING LEVEE TO BE REMOVED
2,000 CFS REMAINING IN CREEK
NEW WEIR AT EL. 92'
BASIN WATER SURFACE MAX. ≅ 92'
NEW CONTAINMENT LEVEE EL≅ 112'
GOLF COURSE

STATION 58+00 LOOKING DOWNSTREAM

GOLF COURSE WEIR SCHEMATIC

FIGURE 6

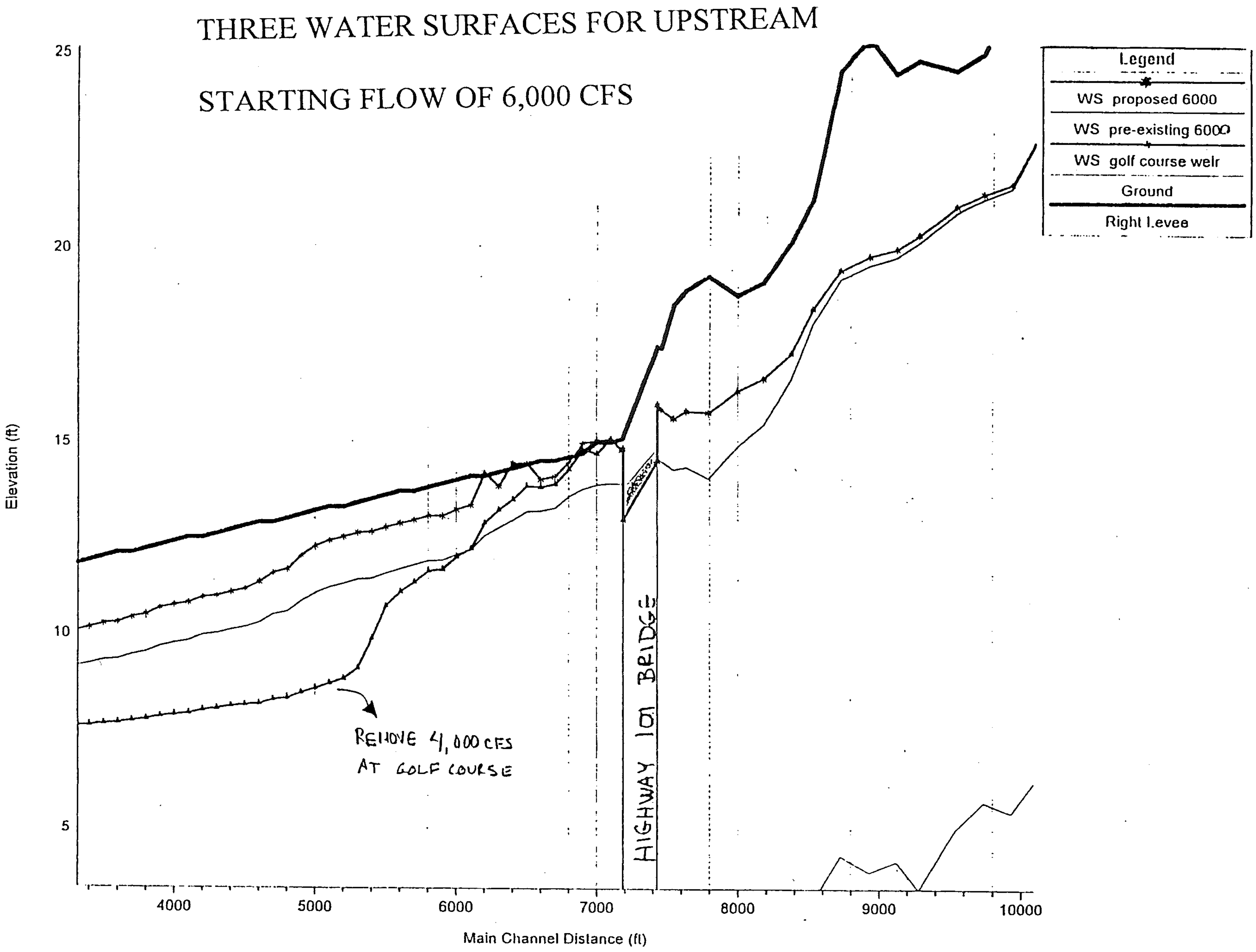


FIGURE 7

GOLF COURSE WEIR PROFILE

The second water surface line, thick and marked with asterisks, shows the expected water surface at a flow of 6,000 cfs after both projects (the Woodland Creek Apartments development and the proposed Levee Restoration Project) are completed.

The third water surface line, also thick but marked with triangles, shows the water surface at a flow of 6,000 cfs, where 4,000 cfs is diverted at the upstream end of the golf course. The plotted line shows a dramatic decrease in water surface elevation at the location of the proposed weir and further downstream. However, it also shows that the upstream flow of 6,000 cfs would quickly, within about 1,000 feet of the weir, reestablish a "normal depth", matching the flow line for the condition without the weir. Upstream of the Highway 101 bridge, the two lines are nearly indistinguishable. There is a calculated difference of about 0.2 feet between the two lines immediately upstream of Highway 101.

Once the basin fills, there would be no capacity to receive additional flow until the basin can be emptied. If a long storm were to occur, or a second storm to immediately follow, there may not be any storage space available in the detention basin. For a one percent event, the basin would offer approximately four hours of protection before it was filled and unavailable for additional storage.

Environmental Considerations

Because a portion of the existing levee would be removed, there would be potential wetland and/or riparian impacts associated with this alternative. In addition, the required ring-levee around the golf course would constitute a major earthworks construction project. For these reasons, an Environmental Impact Report would likely be required for this alternative. State and Federal Regulatory Agency review would also be required, with permit requirements likely.

Time to Implement

Time to plan, design, and conduct environmental reviews would likely take up to two years for this alternative. Construction would likely require an additional six months, depending on the time of year.

Cost

Design and construction of the ring levee, overflow weir and return flow system would cost approximately $3,000,000. Environmental studies, planning and the EIR could cost an additional $500,000 or more.

3.4 ALTERNATIVE 3: DREDGE SEDIMENT DOWNSTREAM OF HIGHWAY 101 TO RESTORE ORIGINAL AS-BUILT CHANNEL CONDITIONS

This alternative would consist of dredging the accumulated sediments from the channel downstream of Highway 101. The accumulated sediment would need to be removed under this alternative. The channel has not been cleared of sediments since 1967. In the ensuing time, benches have formed from tidal sedimentation and vegetation has accrued on the benches. This vegetation is delineated as tidal wetland, and may host sensitive or endangered species, such as the salt marsh harvest mouse.

Hydraulic Performance

By clearing accrued sediments, this alternative would increase the channel cross-sectional area, and therefore improve conveyance of the channel. If all accumulated sediment were cleared from the existing channel, the conveyance capacity would increase from 3,600 cfs to approximately 5,800 cfs. The increased capacity would occur without an increase in water surface elevation, in contrast to Alternative 2: restore elevation to the levees. Therefore, no work would be required upstream of Highway 101.

Most of the sediment in the channel downstream of Highway 101 has been tidally deposited. It has been found that in tidal slough areas, sediments are typically deposited to the elevation of Mean Higher High Water1. In quiescent areas of the South San Francisco Bay, the deposition rate has been noted to be quite rapid. Dredging tidal sediment from the channel would be a temporary measure, and would require diligent monitoring and maintenance of the dredged condition to sustain it. It is not known what environmental requirements would be placed on future dredging activities.

Environmental Considerations

Removing the accrued sediment and associated vegetation would require environmental review, permits and compensatory mitigation. Specifically, permits and/or authorization would be required by the U.S. Army Corps of Engineers, the California Regional Water Quality Control Board, the California Department of Fish and Game, the U.S. Fish and Wildlife Service and the National Marine Fisheries Service.

Time to Implement

This alternative would require extensive planning, negotiation and consultation with regulatory agencies. It would also likely require purchasing, permitting and constructing compensatory wetland mitigation area. These activities could take several years of effort before permission would be granted to dredge the channel.

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[1] Approximately 4 – 5 feet NGVD29 for San Francisquito Creek

Cost

In March, 2000 Santa Clara Valley Water District staff estimated that this alternative would cost $3.7 to $4.2 million, including planning, permitting and implementing the mitigatory wetland area.

3.5 ALTERNATIVE 4: DREDGE SEDIMENT AND RESTORE LEVEES TO THEIR 1958 AS-BUILT ELEVATIONS, TO RESTORE REACH TO ITS ORIGINALLY CONSTRUCTED CONDITION

This alternative combines alternatives 2 and 3, to restore the channel downstream of Highway 101 as it was constructed in 1958. It would both restore the levee elevations to their 1958 grade and remove accumulated sediment from within the channel. This alternative would have the combined effect of increasing the channel capacity by clearing sediment and by restoring the levee elevations, so would restore significant conveyance capacity to the reach downstream of Highway 101.

Hydraulic Impact

Under this alternative, the capacity of the channel would increase from 3,600 cfs to 8,500 cfs to top-of-bank. This is greater than the existing capacity of the upstream areas to convey flow. Capacity beyond 6,000 cfs would provide freeboard.

Environmental Considerations

Removing the accrued sediment and associated vegetation would require environmental review, permits and compensatory mitigation. Specifically, permits and/or authorization would be required by the U.S. Army Corps of Engineers, the California Regional Water Quality Control Board, the California Department of Fish and Game, the U.S. Fish and Wildlife Service and the National Marine Fisheries Service.

The loss of tidal wetland acreage would have to be mitigated.

Cost

The cost for this alternative would be close to the added cost of alternatives 2 and 3.

3.6 ALTERNATIVE 5: LOWER NORTH LEVEE DOWNSTREAM OF PEDESTRIAN BRIDGE, TO ALLOW FLOODING OF ADJACENT WETLAND

This alternative would involve lowering part or all of the existing north (San Mateo County side) levee between the San Francisco Bay (Station 0+00) at the mouth of the creek and the pedestrian bridge (Station 31+50). A portion of the Don Edwards National Wildlife Refuge is situated on the north side of the creek in this reach. This is a tidal wetland sanctuary managed by the U.S. Fish and Wildlife Service. The tidal wetland, on the outboard side of the existing levee, is open to the San Francisco Bay.

The alternative would allow high creek flow events to overflow onto the adjacent marshland, providing some hydraulic relief to the otherwise confined creek. This alternative would also reconnect the creek to part of its historic tidal floodplain. There are potential environmental benefits to reconnecting the creek to its tidal floodplain.

Hydraulic Impact

While this alternative would lower the water surface for a given flow in the lower reaches of the creek, it would not provide significant flood relief in areas further upstream, beyond approximately station 50+00, where residential housing and commercial uses abut the creek. This is because the creek tends to flow at a "normal" depth, which is determined primarily by the slope of the creek and its cross-sectional configuration. Lowering the water surface in the downstream-most reach by allowing creek overflow into the wetland area would provide a lower starting water surface elevation. However, the creek would again rise to its normal depth for a given flow within approximately two thousand feet of the pedestrian bridge.

The areas within the project reach that have the greatest need for flood protection are between 2,500 and 4,500 feet upstream of the pedestrian bridge. The benefit of the lower water surface obtained downstream of the pedestrian bridge would not provide any flood protection in the areas where it is needed. **Figure 8** provides a profile view of the creek at a flow of 4,000 cfs, illustrating a comparison between the water surface under existing conditions and with the lowered north levee. The figures illustrate that by station 50+00 there is no significant difference in the water surface profile with the levee lowered vs. under existing conditions. The top-of-bank capacity of the creek would remain unchanged, at approximately 3,600 cfs.

Environmental Considerations

Because the north levee downstream of the pedestrian bridge abuts a National Wildlife Refuge, lowering it would require coordination with the National Fish and Wildlife Service, which manages the Don Edwards refuge. The Fish and Wildlife Service has indicated that there are sensitive and endangered species in the refuge that could be impacted.

Time to Implement

As with Alternatives 3 and 4, evaluating, permitting and possibly mitigating any environmental impacts associated with the potential project would be the most significant time factor in this alternative. Environmental study and coordination with the appropriate state and federal agencies would probably take several years.

Cost

The principal cost for this alternative would be in the environmental study and permitting process. A scope of study for assessing impacts in a sensitive wetland refuge environment would likely cost $500,000 to $1,000,000. Design and construction costs would add an additional $300,000 for a total of $800,000 to $1,300,000. Costs for environmental mitigation requirements have not been estimated or included here.

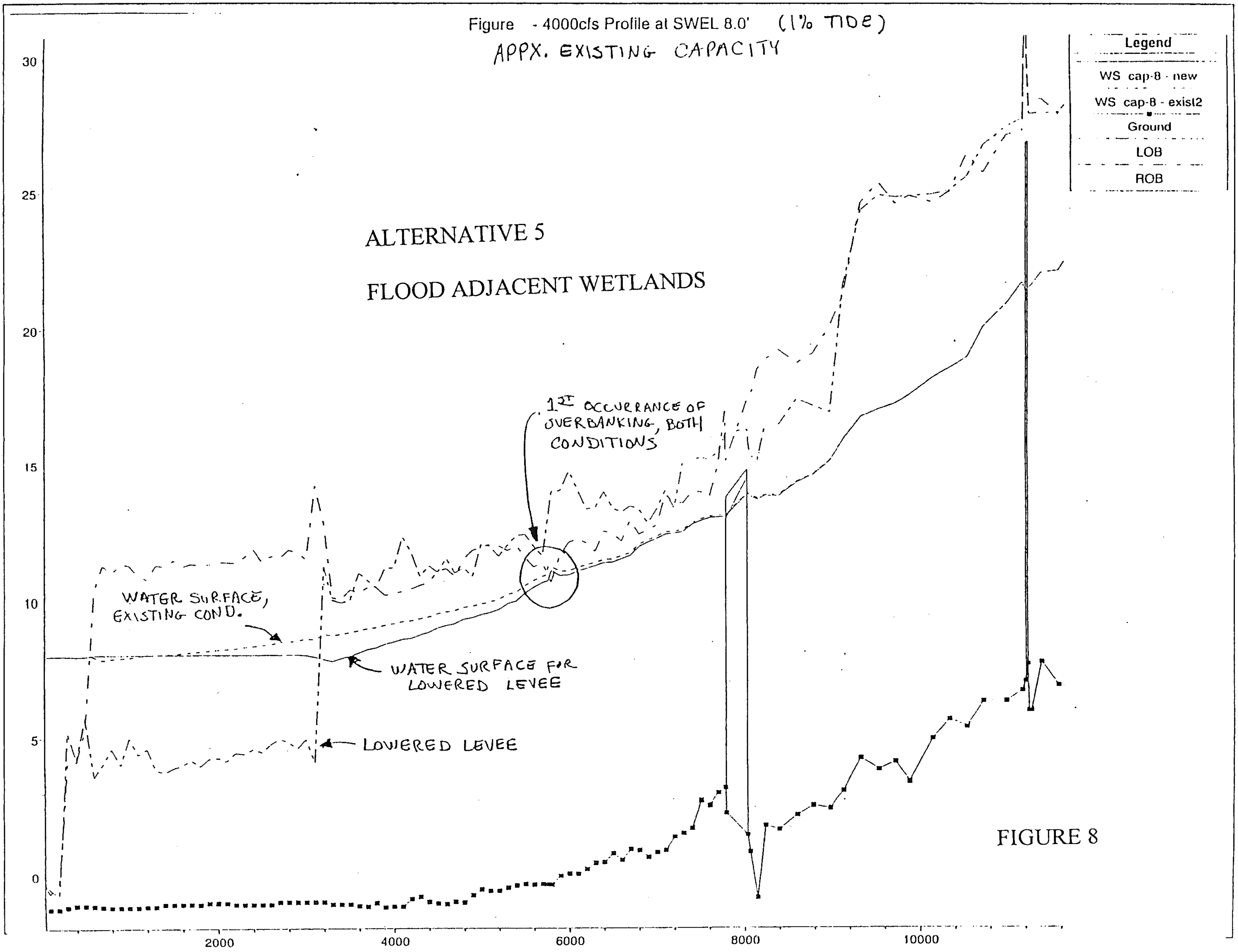


Figure - 4000cfs Profile at SWEL 8.0' (1% TIDE)

APPX. EXISTING CAPACITY

ALTERNATIVE 5

FLOOD ADJACENT WETLANDS

FIGURE 8

3.7 ALTERNATIVE 6: INCREASE LEVEE HEIGHT TO LESS THAN 1958 AS-BUILT

The idea behind this alternative would be to provide an increased level of flood protection to areas downstream of Highway 101, without causing hydraulic impact to the areas upstream of Highway 101. In this way, potential costly mitigation measures upstream of Highway 101 could be avoided. The alternative would define specific areas of levee that could be raised or restored, without impacting the water surface upstream of Highway 101. Levee restoration techniques would be similar to those described in Alternative 2.

Hydraulic Impact

Appendix E presents the results of hydraulic analyses for this alternative; the seven options presented are the result of the attempt to optimize levee restoration without impacting the water surface upstream of Highway 101. While several dozen different combinations of levee raising scenarios were modeled, Appendix E presents eight of the more optimal options. Six of the options present a scenario that provides increased flood protection downstream of Highway 101, without increasing the water surface upstream of Highway 101 by more than 0.2' (The criteria established by the JPA Technical Workgroup).

However, all seven of the analyses presented demonstrate that there would be impacts downstream of Highway 101. In general, the analyses demonstrated that any levee restoration/raising project that provides benefit in the area downstream of Highway 101 would have adverse impacts immediately upstream of the project stopping point. These impacts would continue for several hundred feet. The impacts would be in the form of 1) increasing the water surface by more than 0.2 feet (generally 1/2 foot or more), 2) inducing or increasing flooding, or 3) both. Providing mitigation for such impacts would simply move the project boundary further upstream, hence relocating the impacts further upstream as well.

Environmental Considerations

Environmental considerations for this alternative would be similar to those described for Alternative 2, although possibly even less extensive. However, under CEQA the hydraulic impacts downstream of Highway 101 would need to be called out and categorized as to their significance. Induced flooding would not be considered less-than-significant.

Table 2 provides a summary of the conceptual alternatives.

TABLE 2
SUMMARY OF CONCEPTUAL ALTERNATIVES

CONCEPTUAL ALTERNATIVES							
	Alternative 1 No Project	**Alternative 2** Restore Levees to 1958 Elevations	**Alternative 2A** Overflow Weir at Golf Course	**Alternative 3** Dredge Sediment	**Alternative 4** Combined Dredge Sediment w/ Restore Levees	**Alternative 5** Lower North Levee at Wildlife Refuge	**Alternative 6** Increase Levee Height to less than 1958 As-Built
Description	No action. Existing conditions remain	Levee work on both sides of the creek to restore top of levee elevations to the 1958 as-built elevations.	Use the golf course as a temporary detention basin during high flow events.	Dredge sediment to restore 1958 channel x-section	Dredge sediment and restore levees to 1958 as-built conditions	Lower part or all of the existing north levee . This would allow high flows to overflow onto the adjacent marshland	Would define specific areas of the levee that could be raised without impacting the water surface U/S of Hwy. 101
Potential Environmental Impact to Wetlands	0	0	0	8 acres	8 acres	0	0
Mitigation Required	0	Avoids impacts to wetlands and mature vegetation. All work outside and near channel to be accomplished with BMPs	Potential wetland and/or riparian impacts. Major earthworks construction impacts for ring levee around the golf course	24 acres of tidal wetland	24 acres of tidal wetland	Sensitive or endangered species may be impacted in the marshland	Avoids impacts to wetlands and mature vegetation. All work outside and near channel to be accomplished with BMPs
Hydraulic Performance/Capacity	4,000 cfs	5,900 cfs	Does not increase capacity in target area	>5,900 cfs	>5,900 cfs	Does not increase capacity in target area	Does not meet capacity objective
Estimated Construction Date	NA	2002	2003	2003	2003	2004	2003
Costs Construction	NA	$2.5 M	$3 M	$4M	$5M	$1.3 M without environmental costs	Less than $2 M
Summary	Not feasible because it does not provide increase in protection	Does not meet desired construction date BUT provides one of the best opportunities for earliest possible construction.	Not feasible because it does not provide increase in protection	Not feasible because of cost, impacts to environment and time to implement	Not feasible because of cost, impacts to environment and time to implement	Not feasible because it does not provide increase in protection	Not feasible because it does not provide sufficient flood protection

SECTION 4

4.1 PROPOSED PROJECT

Alternative 2 was selected as the proposed project since it best meets the project's objectives, and minimized cost and impacts. This alternative was selected for study by the JPA in September 2000. This Alternative would restore the gradeline of levees to match the original 1958 top-of-levee grade. The levees would be raised with compacted earth, increasing the footprint area. In areas confined by wetlands or by right-of-way restrictions, levees would be raised with reinforced soil. No work would be performed downstream of pedestrian bridge. The Hydraulic conveyance would be approximately 5,900 cfs..

4.2 DESCRIPTION OF PROPOSED PROJECT

The proposed project is a combination of raising earthen levees, reinforced levee, and replacing an existing floodwall **(see Figure 9).**

The project will restore approximately 4,400 feet of existing levee on each side of San Francisquito Creek downstream of Highway 101, for a total levee length of approximately 8,800 feet, by adding 0.7 to 2.6 feet of fill material. The existing bike path on top of approximately 2600 feet of the Palo Alto side levee downstream of Highway 101 will be reconstructed. Vertical levee banks will be introduced at select locations to avoid impacting environmentally sensitive wetland habitat and other local vegetation. Vertical levee banks will be accomplished by the use of an earth retaining system that meets current engineering and environmental requirements.

Upstream of West Bayshore Road, 1,042 feet of existing sacked concrete wall will be replaced with a new reinforced concrete wall. The existing wall was built in 1958 and varies from 1.1 feet to 4.1 feet in height. The new wall will vary from 2.3 feet to 5.2 feet in height.

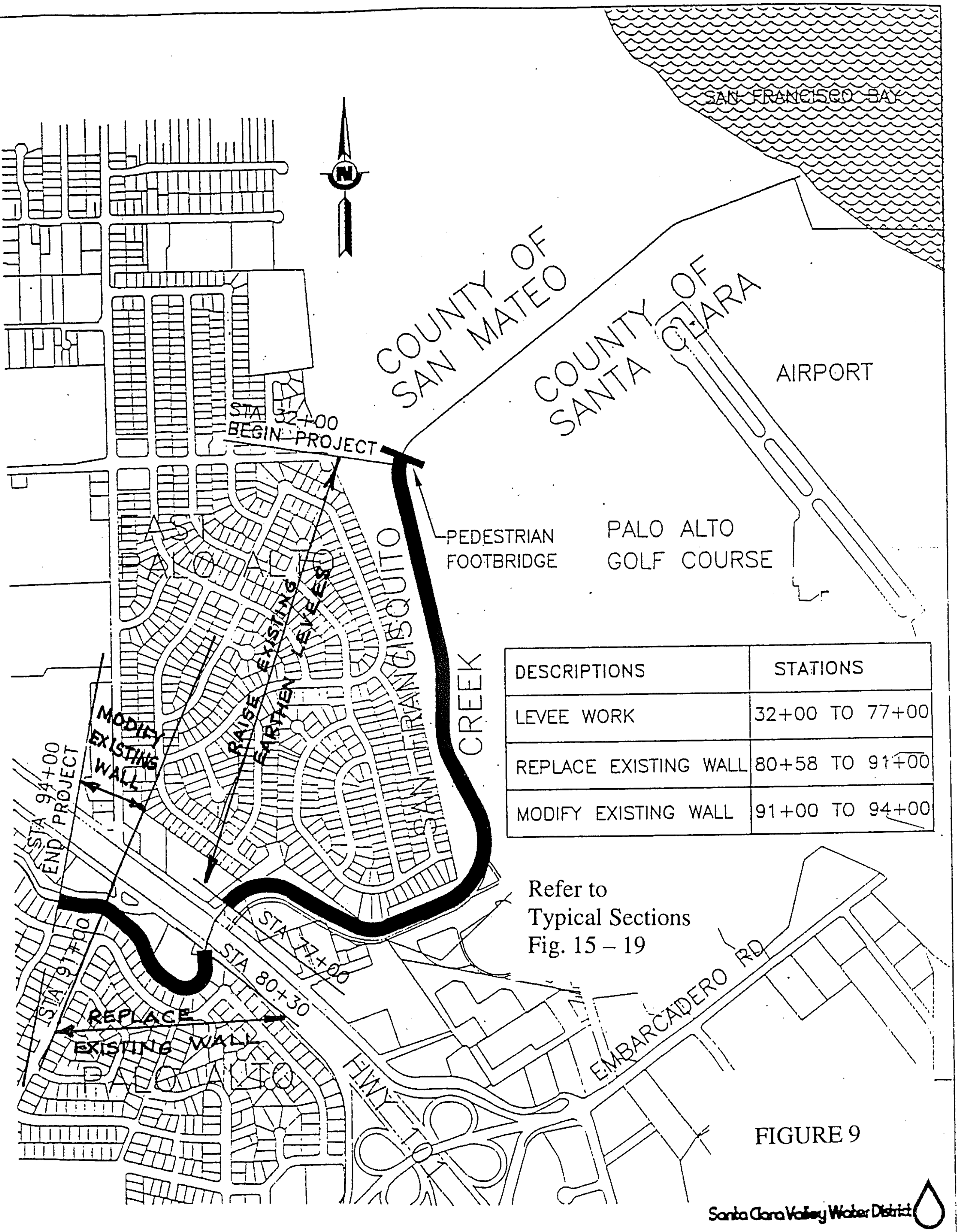
Immediately upstream of the 1958 floodwall, the project will add about 6 inches to the height of the existing 1969 sacked concrete floodwall by adding one layer of sacked concrete.

Appendix C refers to the Hydraulic Analysis (the HEC Floodwater Profile Analysis for the proposed project.

Appendix F refers to the Geotechnical Investigation.

4.3 PROPOSED PROJECT SPECIFICS

Levee work would be designed to restore the top of levee elevations along both sides of the creek to the 1958 as-constructed elevations. Figures 2 and 3 illustrate schematically the work on each side of the creek required to match 1958 levee elevations. The figures present a comparison between the existing levee surface as surveyed in 1999 and the 1958 as-constructed levee grade line. Where the existing levee is below the 1958 levee, it will be to match the 1958 elevation. This will entail adding a minimum of about 0.5 feet up to a maximum of about 2.6 feet of fill material to the levee top.



DESCRIPTIONS	STATIONS
LEVEE WORK	32+00 TO 77+00
REPLACE EXISTING WALL	80+58 TO 91+00
MODIFY EXISTING WALL	91+00 TO 94+00

Refer to Typical Sections Fig. 15 – 19

FIGURE 9

Santa Clara Valley Water District

San Francisquito Creek Levee Restoration Project Features

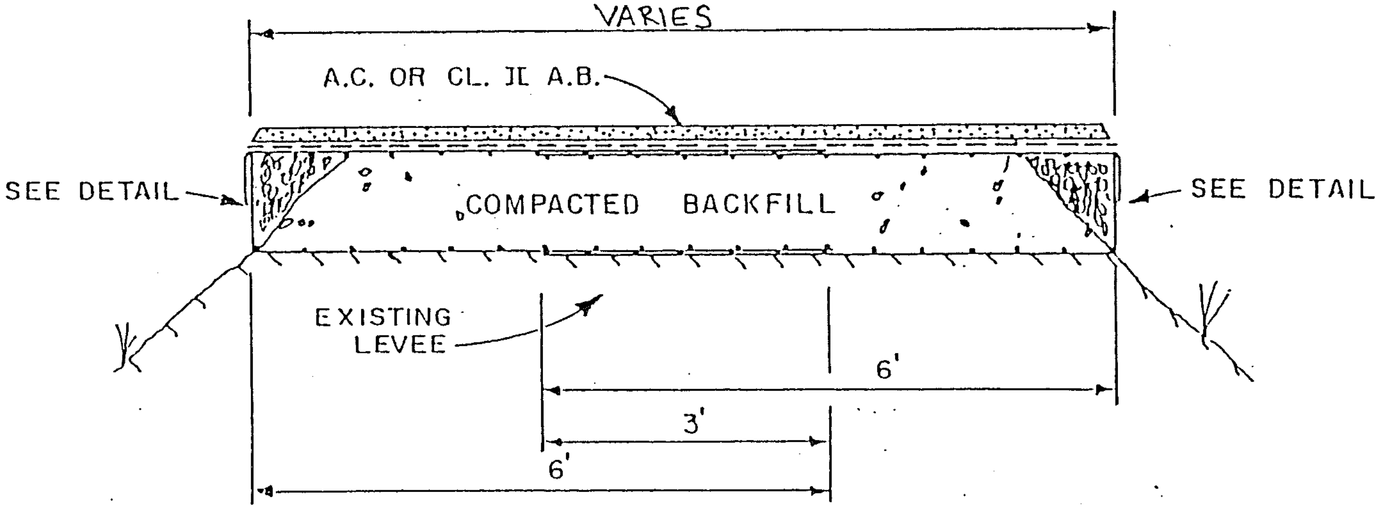
Downstream of Highway 101, the earth levees would be raised with a 2:1 side slope, which would result in expansion of the levee footprint on one side. To achieve a 2:1 side slope while maintaining adequate topwidth for a maintenance road, one side of the levee would be completely cleared of vegetation and the levee would be overbuilt on that side. **Figure 4** illustrates this traditional means of levee reconstruction. The levee footprint would be expanded approximately 2 to 6 feet beyond its existing configuration. During construction, the levee would be overbuilt an additional two feet, to obtain proper earth compaction and slope stability along the newly constructed edge. After compaction is complete, the overconstructed levee would be graded back to the final levee configuration.

To minimize environmental impacts, earth fill used to restore levee height would not be placed within the existing creek channel area. In most areas, the levee would be overbuilt on the outboard side. However, in some locations on the San Mateo County side of the creek, there is insufficient right-of-way on the outboard side, and the inboard side is actually set back from the creek by a significant amount. In those areas, the levee would be expanded on the creek side of the levee. The project has been carefully designed so that no wetland area would be impacted by the expanded footprint of the restored levee. **Figure 4** shows typical cross-sections for levee height restoration techniques.

Some areas of levee are confined both on the inboard and outboard sides by existing wetland areas. Some wetland areas have been delineated outside the channel, on the outboard side of the levees. Some levee areas have mature vegetation on both the inboard and outboard side of the levee. To avoid impacts to these areas, reinforced earth would be used instead of compacted earth slopes to add the required height to the levees. The reinforcing structure, consisting of steel wire grids, would allow vertical addition of levee height without requiring clearing of one side of the levee, as described above. **Figure 10** presents a typical cross-section of the soil reinforcement technique proposed for use in this project, and **Figure 11** presents a typical detail for the method. This technique was used by the City of Palo Alto in 1983 to increase levee height for installation of the pedestrian bridge at station 31+50.

In general, the Santa Clara County side of the creek, downstream of Highway 101 will use the reinforced earth technique for the length of the project. On the San Mateo County side of the creek, most of the project will use the traditional compacted earth levee restoration technique, except in a few areas where wetlands have been delineated on both the inboard and outboard side of the creek, or where existing utilities require special attention.

No work is proposed downstream of the pedestrian bridge, Station 31+50. On the Palo Alto side of the creek, the existing levee top is above the 1958 elevations, so no work would be required in that area (see **Figure 2**). On the San Mateo County side of the creek, the levee abuts a portion of the Don Edwards National Wildlife Refuge, a sensitive area containing wetland species. The existing levee in that area, while in some places below the 1958 elevations, is at all places above the calculated water surface profile for the FEMA 1% flow of 6,000 cfs at the 1% tide of 8 feet (**See Figure 5**).

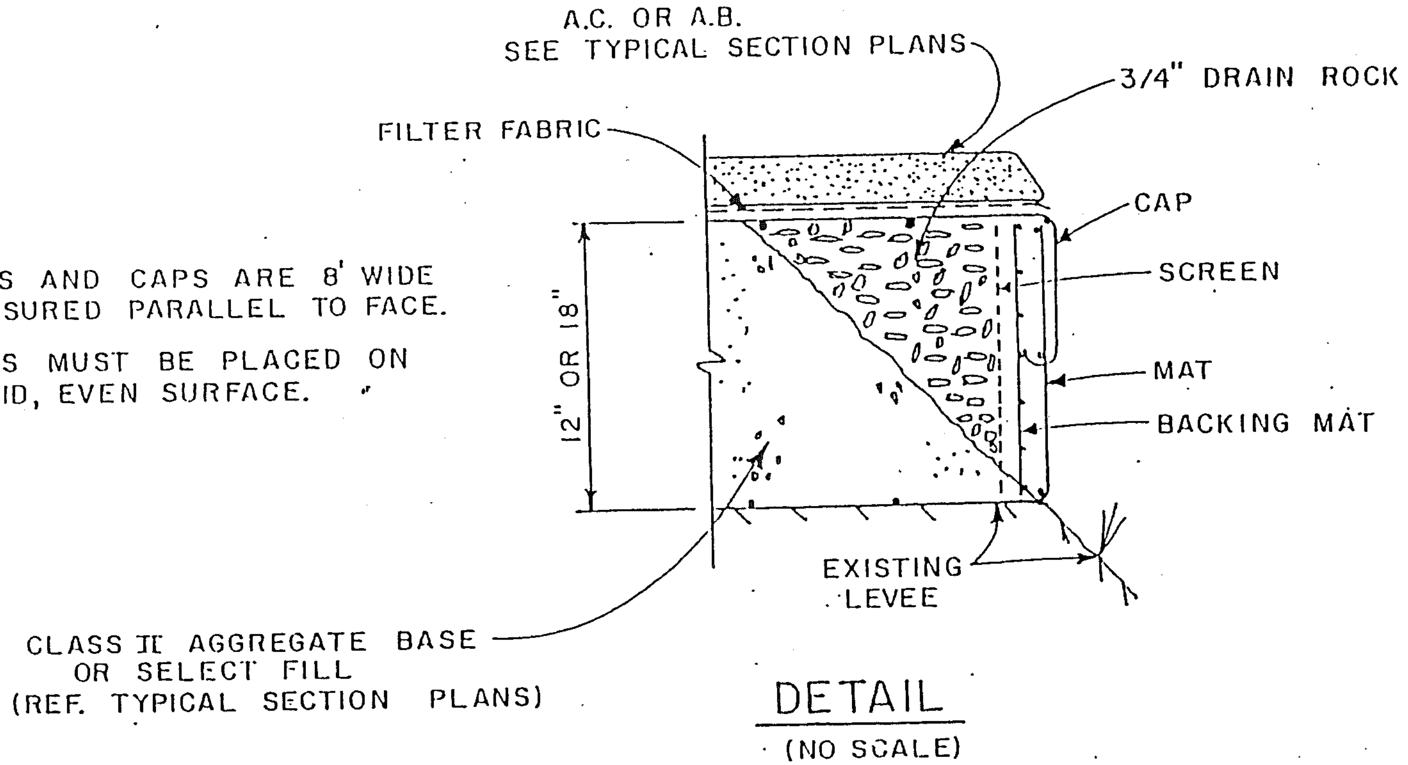


WELDED WIRE WALL
TYPICAL CROSS SECTION
(NO SCALE)

NOTE: THIS WELDED WIRE WALL DETAIL IS MANUFACTURED BY HILFIKER RETAINING WALLS. WELDED WIRE WALLS MANUFACTURED BY OTHERS MAY VARY SLIGHTLY.

PROPOSED LEVEE SOIL REINFORCEMENT

FIGURE 10



1. MATS AND CAPS ARE 8' WIDE MEASURED PARALLEL TO FACE.
2. MATS MUST BE PLACED ON SOLID, EVEN SURFACE.

PROPOSED LEVEE SOIL REINFORCEMENT

FIGURE 11

Hydraulic Impact Section

The existing capacity of the project reach is approximately 3,600 cfs to 4,000 cfs to the top of bank (no freeboard at this flow). This corresponds to approximately a 4 to 6-year return period. The restored levee will convey approximately 5,900 cfs, corresponding to approximately a 16-year return period. This flow would reach the top of bank in the area just downstream of Highway 101. The project would not provide protection to the 1% event, because it is designed to restore a previously constructed levee, not to convey a particular flow.

Restoration of the levees downstream of Highway 101 will result in an increased water surface elevation, due to the containment of additional flow, compared to what would be conveyed in the channel under existing conditions for flows above approximately 4,000 cfs.

The increased water surface would not result in overbanking except for a length of about 14 feet of channel, on the San Mateo County side of the creek, immediately upstream of the West Bayshore bridge. In all other areas, the increased water surface elevation would reduce freeboard, but not induce flooding for the 1% event.

The Woodland Creek Apartment development was in the planning stages when the subject Levee Restoration Project study was initiated (see previous section, Setting). In the interim, a substantial amount of grading and construction work has been completed on the Woodland Creek site. The increased water surface elevation resulting from the Woodland Creek Apartment development occurs at a similar location as the increased water surface resulting from the proposed Levee Restoration Project. Because of the concurrence of the Woodland Creek Development with the proposed Levee Restoration Project, this hydraulic analysis includes a separate analysis for each of the two projects as well as the cumulative impact of both projects as compared to pre-existing conditions.

Table 3 presents the hydraulic impact in terms of the increased water surface at 6,000 cfs for the area upstream of Highway 101 resulting from:

- The Woodland Creek Apartments development
- The Proposed Levee Restoration Project, and
- The Cumulative Impact of both projects together

Figure 12 illustrates the separate impact from each of the two separate projects, and the cumulative impact of the two projects combined.

The preceding information is based on analyses provided by Northwest Hydraulics, Inc. Appendix C presents the data and summary memorandum provided by Northwest Hydraulics, Inc.

Table 3: Hydraulic Impact of Two Separate Projects in Vicinity of Highway 101 on San Francisquito Creek calculated at FEMA existing 1% flow of 6,000 cfs

River Station (equivalent to distance from Bay, ft.)	Distance Upstream of Highway 101 Bridge Face (ft)	Increase in Water Surface Resulting from Project (feet)		
		Woodland Creek Apartments Development (Currently under construction, to be completed 2001)	Restoration of levees to 1958 elevations	Cumulative Impact of Both Projects
8030	1	0.0	0.7	0.7
8057.6	29	0.0	0.7	0.7
8145.3	116	-0.1	0.7	0.6
8233	204	0.1	0.7	0.8
8390	361	0.2	0.7	0.9
8595	566	0.4	0.5	0.9
8778	749	0.4	0.4	0.8
8973	944	0.2	0.3	0.4
9128	1,099	0.2	0.2	0.4
9324	1,295	0.1	0.1	0.2
9529	1,500	0.1	0.1	0.2
9721	1,692	0.1	0.1	0.2
9879	1,850	0.1	0.1	0.2
10143	2,114	0.1	0.1	0.1
10333	2,304	0.1	0.1	0.1
10530	2,501	0.1	0.0	0.1
10716	2,687	0.1	0.0	0.1
10976	2,947	0.0	0.0	0.0
11155.5	3,127	0.0	0.1	0.0
11193	3,164	0.0	0.1	0.0

Figure 12 : Hydraulic Impacts Upstream of Hwy 101
6,000 cfs

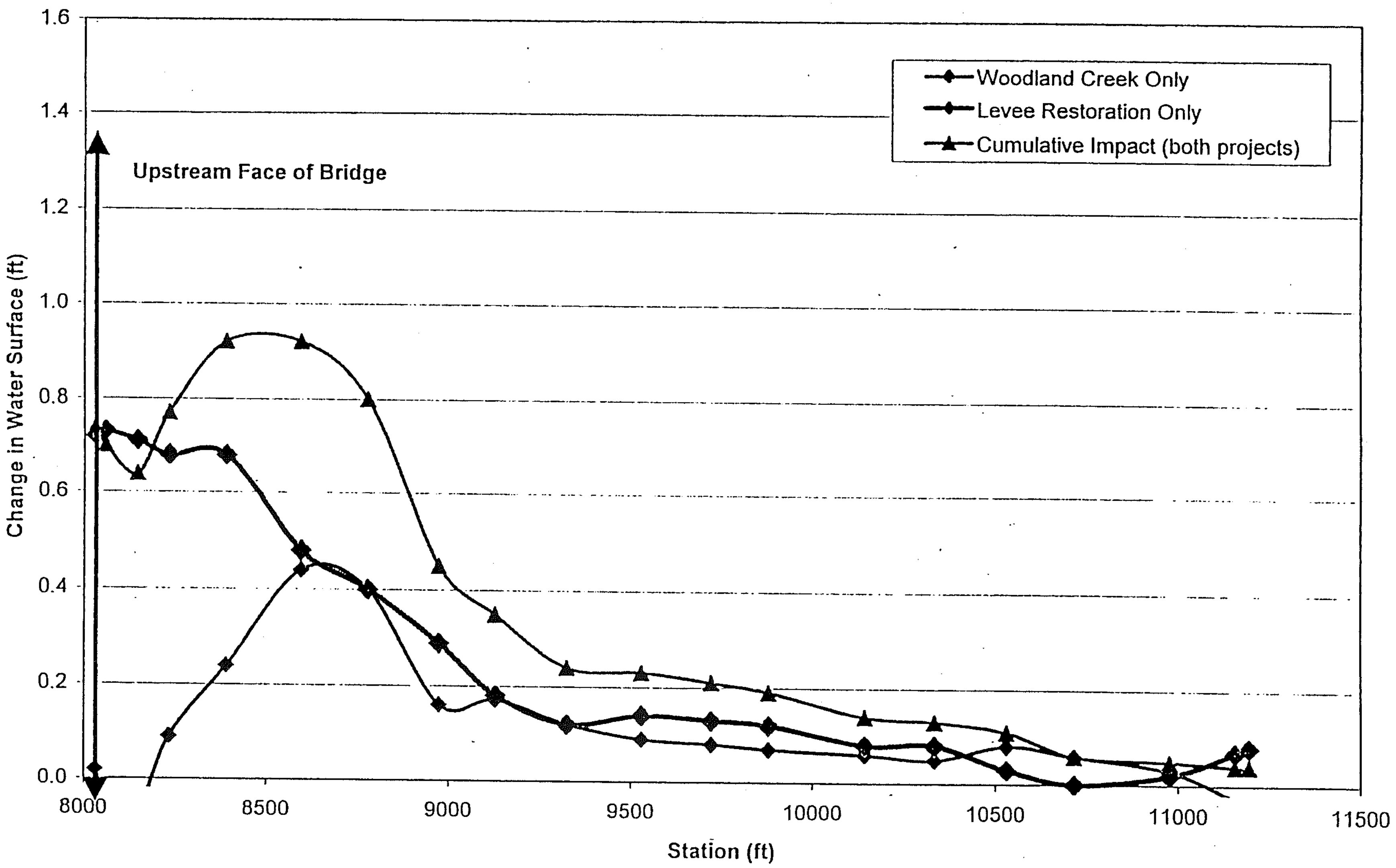


FIGURE 12

Hydraulic impacts in the form of loss of freeboard would be avoided by raising the wall on the Santa Clara County side and constructing a low wall on the San Mateo County side, upstream of Highway 101. On each side of the creek, the wall would be raised by an amount equivalent to the maximum anticipated increase in water surface for the existing 1% flow conditions. The height of the walls will be increased less than one foot for a distance of approximately 1,800 feet upstream of Highway 101.

Downstream of the proposed project location, from the pedestrian bridge to the San Francisco Bay, the increased confined flow would result in an increased water surface compared to existing conditions at the 1% FEMA flow. The increase would be generally less than one-half foot. This flow would be contained by the existing levees, with freeboard (See Figures 13 and 14). No additional levee work is proposed in the approximately 3,000 feet between the pedestrian bridge and the Bay because on the Santa Clara County side of the creek, the existing levee is higher than the 1958 plan elevations, and on the San Mateo County side of the creek, the levee abuts a portion of the Don Edwards National Wildlife Refuge. Construction impacts of raising the levee in that area would likely be more significant than the loss of freeboard resulting from the proposed project. A natural tidal wetland (the US Fish and Wildlife Refuge) is open to the Bay on the outboard side of the San Mateo County levee. This area would be inundated by Bay tides during extreme high tide events, but is not expected to be inundated by creek flow even during extreme high flow events (up to the 1% FEMA flow), because the existing levee would serve to separate the wetland from the creekflow. Upstream of Highway 101, some improvements are proposed between stations 80+30 and 98+00 to mitigate for an increased water surface elevation due to the cumulative impacts of the proposed project and a recent creekside residential.

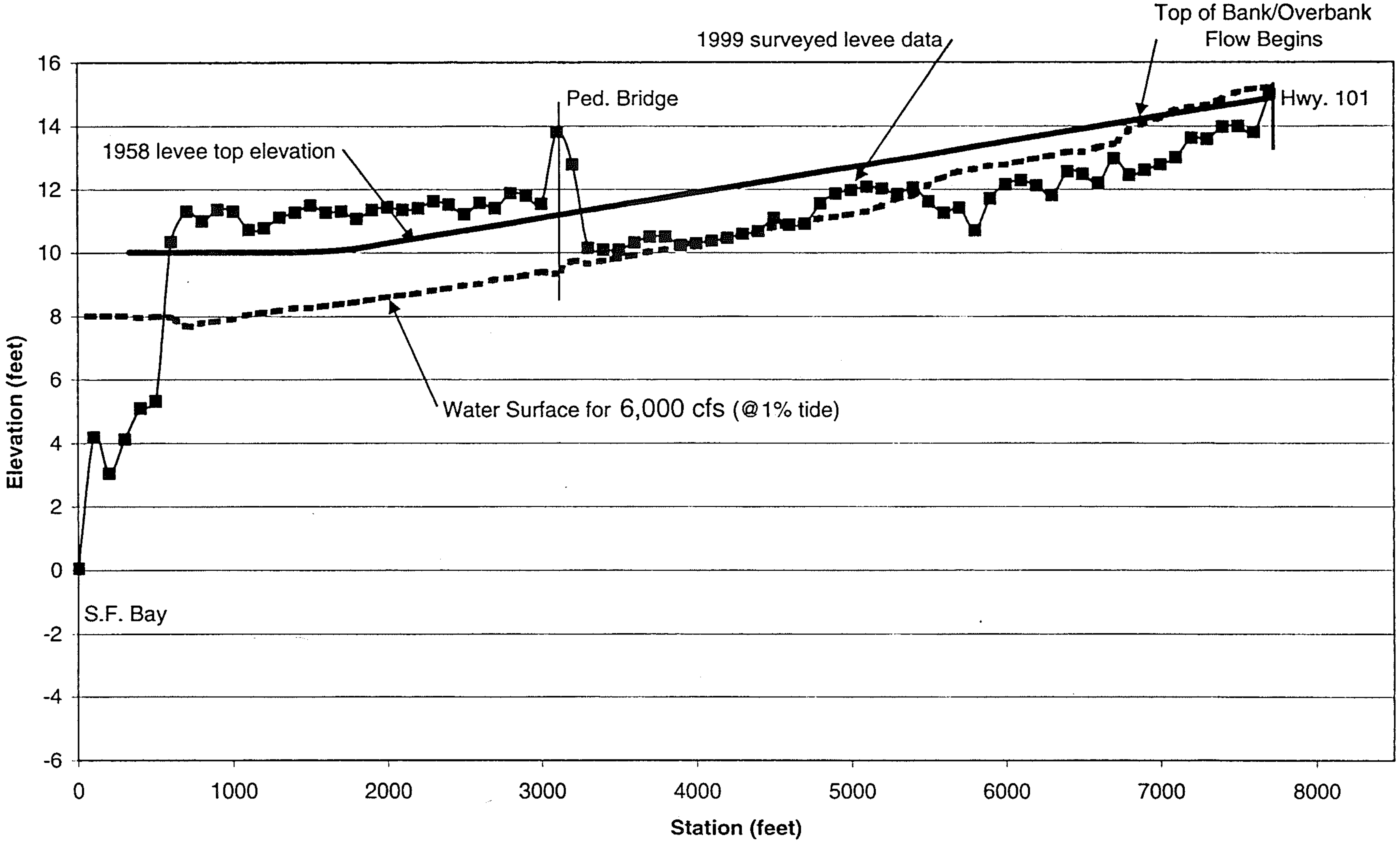
The following general concepts for work upstream of Highway 101 have been agreed to by JPA member agencies. Specific construction techniques have been added for clarity.

- Flood protection measures upstream of Highway 101 are proposed between Highway101 and the upstream location where the cumulative increase in water surface for the 1% FEMA event falls to 0.2 feet (or about 2½ inches). This location corresponds approximately to District centerline station 98+00, making the work upstream of Highway 101 approximately 1,800 feet long on each side of the creek.

- On the San Mateo County side, concrete cinder blocks will be used to add the required height to approximately 700 linear feet of the existing concrete gravity wall upstream of the new residential development, along Woodland Avenue in East Palo Alto. That is, from approximately station 91+00 where the gravity wall begins, to station 98+00, the end of the project. Access to this work will be from Woodland Avenue, and will be accomplished with hand tools.

- On the Santa Clara County side, a new concrete wall would replace the existing sacked concrete wall immediately upstream of Highway 101 for several hundred feet. The existing wall was not constructed to meet present structural standards and it is not possible to extend the wall height without replacing the existing wall. Removing the existing wall will include removal and disposal of the concrete sacks that form the

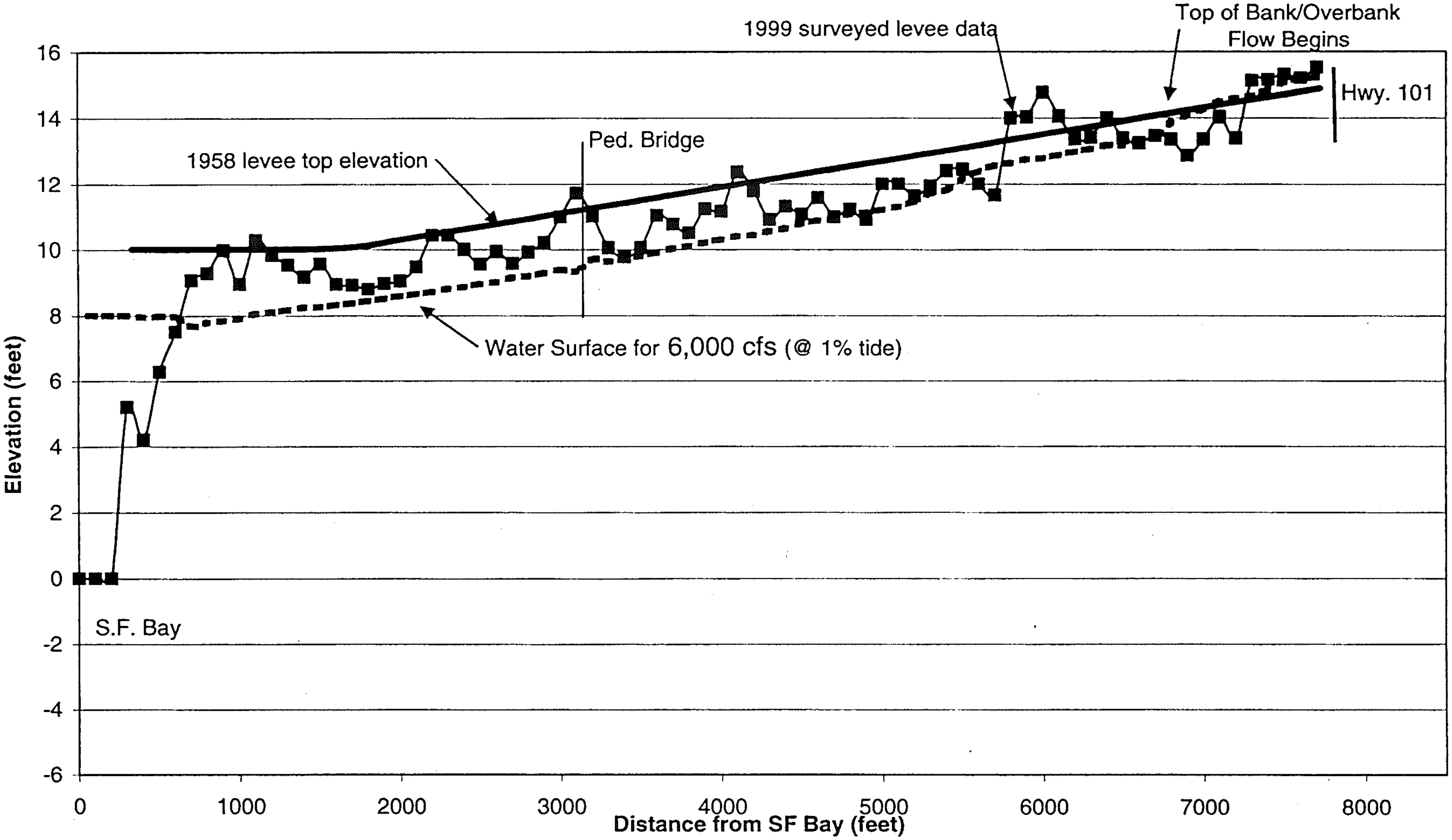
Compare Levee Heights to 6,000 cfs
Santa Clara County Side



PROPOSED PROJECT

FIGURE 13

Compare Levee Heights to 6,000 cfs
San Mateo County Side



PROPOSED PROJECT

FIGURE 14

existing wall. Forming the new wall will entail trenching up to four feet deep and four feet wide along the top of bank, to provide adequate footing for the new wall. This will be accomplished with small trenching machinery from the top of bank. There is a SCVWD easement along the top of bank that will be used to access and work on the wall. This easement strip will allow access by small machinery, but not heavy equipment. The wall will be cast-in-place concrete. See Appendix G for the Structural Evaluation Report on the Sack Concrete Wall.

- Where structurally feasible, instead of removing and replacing the existing wall, additional sacks will be installed on top of the existing sacked concrete wall on the Santa Clara County side to add the required wall height.
- The goal of the work upstream of Highway 101 is to mitigate any adverse impacts on the level of flood protection as existed in pre-project conditions.

Figure 15 provides easement information and **Figures 16 - 19** refer to cross section information for this proposed project.

Maintenance

Maintenance of the proposed levee restoration areas will be consistent with the SCVWD existing Baseline Maintenance Program for levees. This includes monitoring for erosion, seepage, caving or settlement; periodic vegetation control; monitoring for rodent damage; and maintaining the roads in serviceable condition. Environmental impacts from maintenance activities would be covered under the SCVWD's existing maintenance program. If additional environmental clearance were required for maintenance activities, they would be handled separately on a case-by-case basis. Appendix D presents the levee maintenance guidelines that would continue to be followed for San Francisquito Creek.

Environmental and Regulatory Considerations

This Alternative 2 as the proposed project has been designed to avoid impacts to wetlands and mature vegetation. All work would be accomplished outside of the channel and ordinary high water line, with Best Management Practices (BMPs) implemented to avoid potential impacts to the water quality of the creek, and also mitigated with specific construction techniques (reinforced soil). There will be potential short-term disruption to existing recreational path use and temporary impacts during construction (air, noise, traffic) that will be mitigated with implementation of BMPs. These issues have been clearly defined in the Initial Study and Mitigated Negative Declaration provided in **Appendix B**.

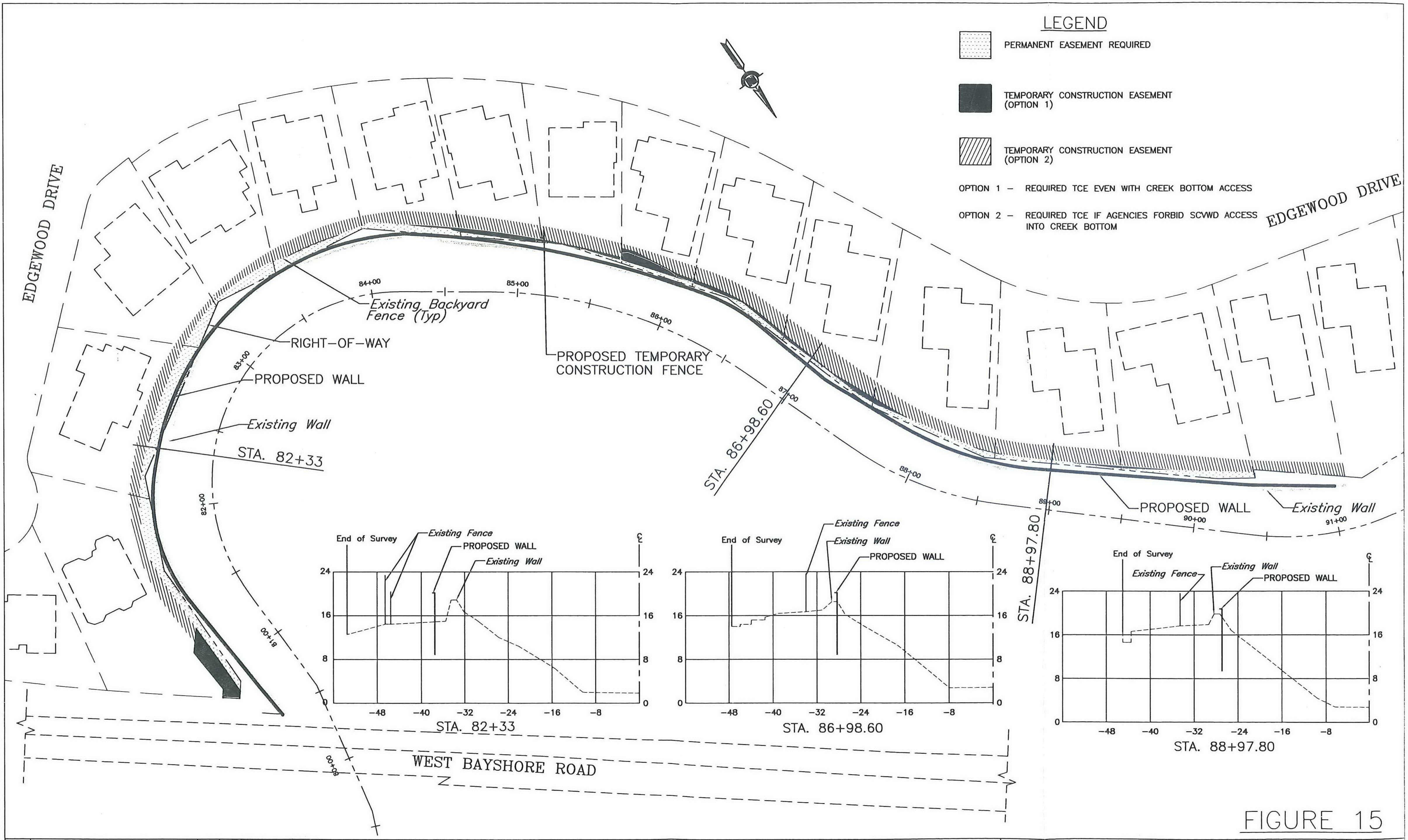


FIGURE 15

DWG FILE NAME: G:\dwgs\Land Projects 3\102806\RE_DISPLAY\RE_DISPLAYALL1.DWG

REV	DESCRIPTION	DATE	APPR	REFERENCE INFORMATION AND NOTES

DATE 03/24/2002

DESIGN

DRAWN

CHECKED

Santa Clara Valley Water District

ENGINEERING CERTIFICATION

PROJECT ENGINEER R.C.E.XXXXXX

ENGINEERING APPROVAL

UNIT MANAGER R.C.E.XXXXXX

SAN FRANCISQUITO CREEK

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
NTS

SHEET
15

PROPOSED PROJECT

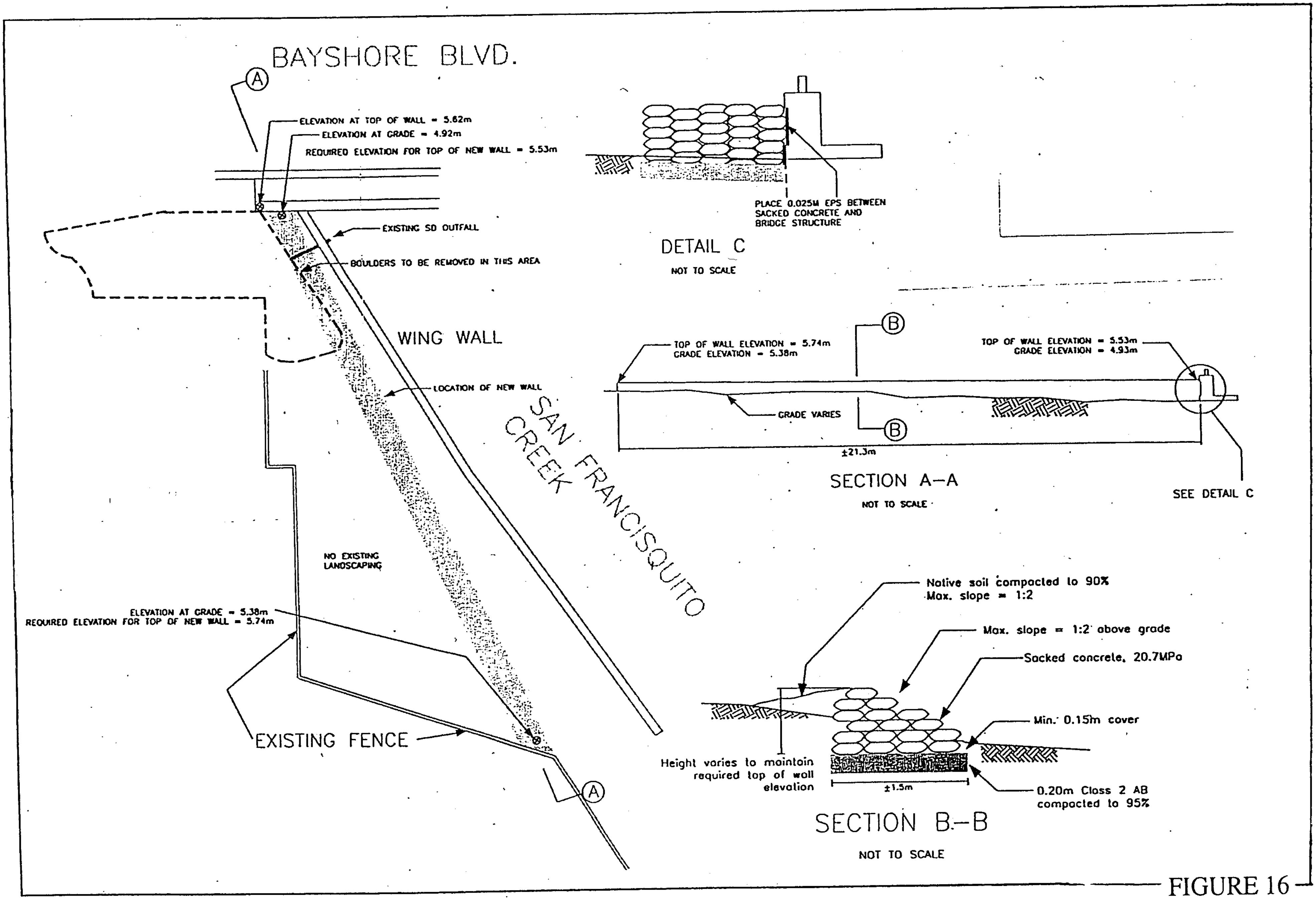
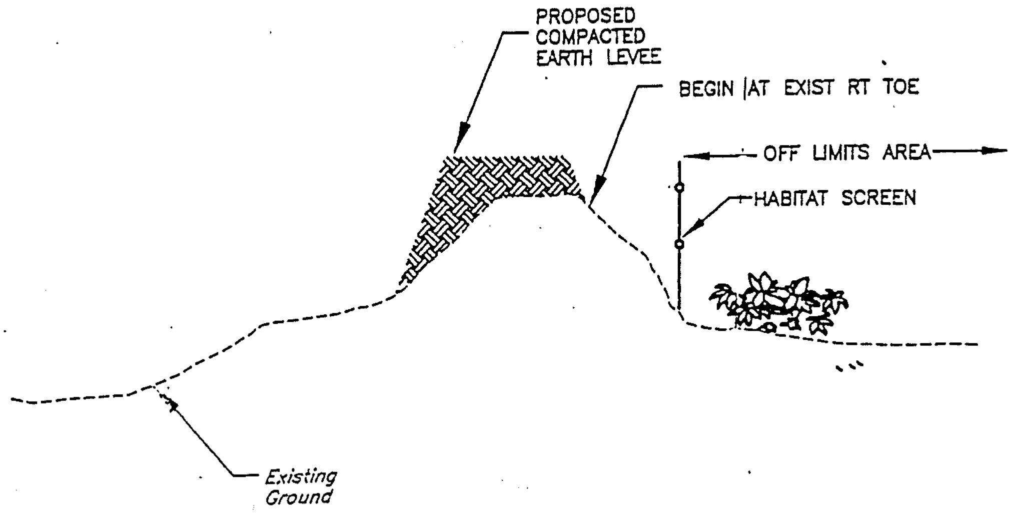

BAYSHORE BLVD.
A
ELEVATION AT TOP OF WALL = 5.62m
ELEVATION AT GRADE = 4.92m
REQUIRED ELEVATION FOR TOP OF NEW WALL = 5.53m
EXISTING SD OUTFALL
BOULDERS TO BE REMOVED IN THIS AREA
WING WALL
LOCATION OF NEW WALL
SAN FRANCISQUITO CREEK
NO EXISTING LANDSCAPING
ELEVATION AT GRADE = 5.38m
REQUIRED ELEVATION FOR TOP OF NEW WALL = 5.74m
EXISTING FENCE
A
PLACE 0.025M EPS BETWEEN SACKED CONCRETE AND BRIDGE STRUCTURE
DETAIL C
NOT TO SCALE
B
TOP OF WALL ELEVATION = 5.74m
GRADE ELEVATION = 5.38m
TOP OF WALL ELEVATION = 5.53m
GRADE ELEVATION = 4.93m
GRADE VARIES
B
±21.3m
SECTION A—A
NOT TO SCALE
SEE DETAIL C
Native soil compacted to 90%
Max. slope = 1:2
Max. slope = 1:2 above grade
Sacked concrete, 20.7MPa
Min. 0.15m cover
Height varies to maintain required top of wall elevation
±1.5m
0.20m Class 2 AB compacted to 95%
SECTION B—B
NOT TO SCALE

FIGURE 16



CITY	FROM STATION	TO STATION	TOTAL LENGTH (FEET)
E.PALO ALTO	55+50	71+00	1,550′

FIGURE 17

DATE 3/8/02
DESIGN R. WEESE
DRAWN CAM
CHECKED

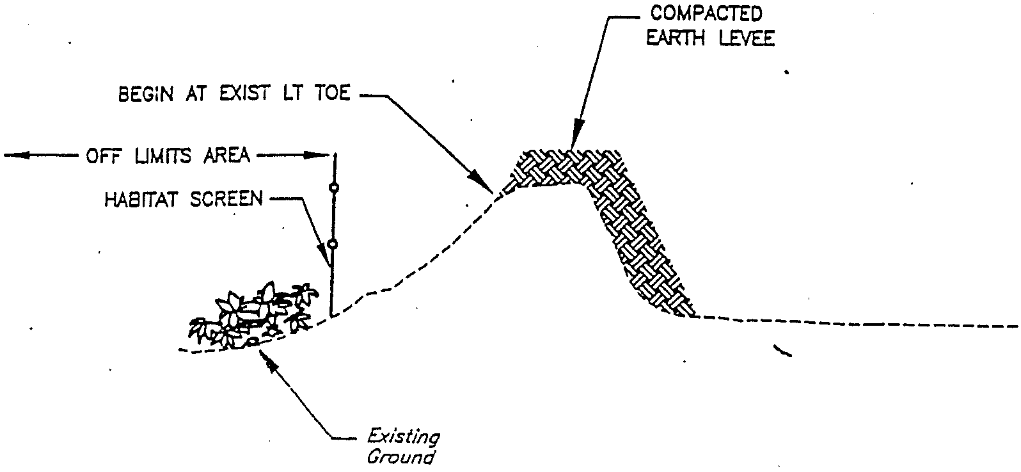
Santa Clara Valley Water District

ENGINEERING CERTIFICATION
PROJECT ENGINEER

ENGINEERING APPROVAL
UNIT MANAGER

SAN FRANCISQUITO CREEK
D/S HWY 101
(LOOKING U/S)
TYPICAL CROSS SECTIONS

SCALE NTS
SHEET 1 OF 1



CITY	FROM STATION	TO STATION	TOTAL LENGTH (FEET)
E.PALO ALTO	32+15	43+00	1,085′
	45+00	50+00	500′
	73+00	74+65	165′

FIGURE 18

DATE 3/8/02
DESIGN R. WEESE
DRAWN CAM
CHECKED

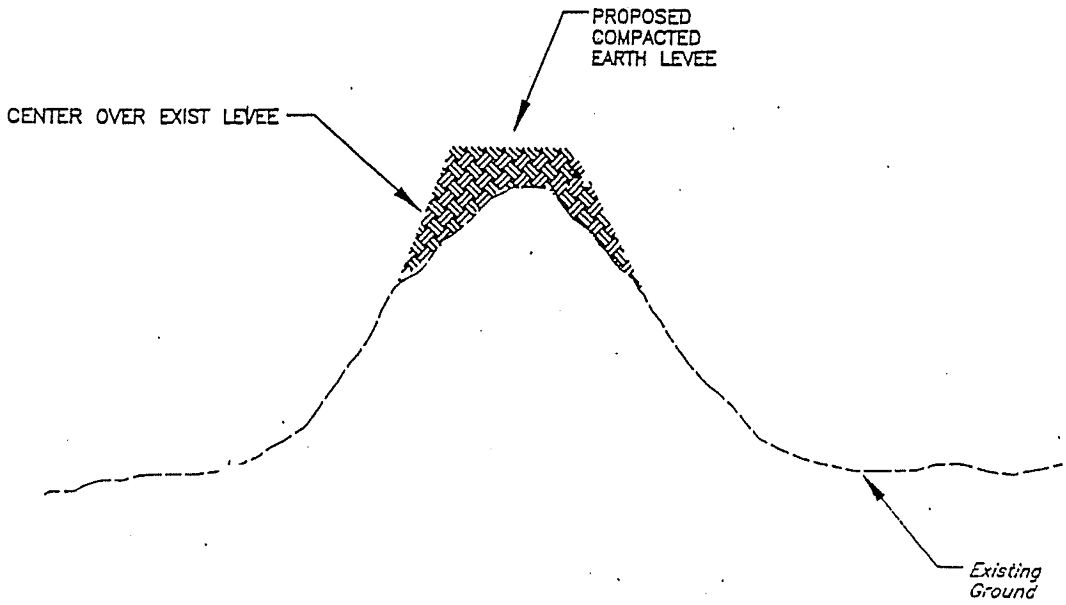
Santa Clara Valley Water District

ENGINEERING CERTIFICATION
PROJECT ENGINEER

ENGINEERING APPROVAL
UNIT MANAGER

SAN FRANCISQUITO CREEK
D/S HWY 101
(LOOKING U/S)
TYPICAL CROSS SECTIONS

SCALE NTS
SHEET 1 OF 1



CITY	FROM STATION	TO STATION	TOTAL LENGTH (FEET)
PALO ALTO	70+00	74+65	465’

FIGURE 19

DATE 3/8/02
DESIGN R. WEESE
DRAWN CAM
CHECKED

Santa Clara Valley Water District

ENGINEERING CERTIFICATION
PROJECT ENGINEER

ENGINEERING APPROVAL
UNIT MANAGER

SAN FRANCISQUITO CREEK
D/S HWY 101
(LOOKING U/S)
TYPICAL CROSS SECTIONS

SCALE NTS
SHEET 1 OF 1

4.4 PROJECT COST AND FINANCING

The estimated cost for the proposed project is approximately $2,500,000.

This includes Planning and Design (Including Environmental (CEQA) and Hydraulic Analyses and Review), Construction Downstream Of Highway 101, Construction Upstream of Highway 101, and Construction Administration and Inspection.

Of this $2,500,000, the Planning, CEQA, Design and Construction costs are approximately $1,800,000. East Palo Alto is responsible for all construction work on the San Mateo County side of the creek with cost sharing by other JPA members. The City of Palo Alto will fund the reconstruction of a bike path on the downstream portion of the levee in Palo Alto. All other construction work in Santa Clara County will be funded by the District, with some cost sharing by other JPA members. There is the easement acquisition and backyard restoration cost of approximately $650,000. This easement cost would be borne by the District.

The District will fund work through existing tax revenues and Measure B revenues (Clean, Safe Creeks Program).

The District will receive reimbursement from other JPA members for the District's project management and design activities since the District is administrating the entire construction project. Reimbursement for San Mateo County's CEQA work has not been finalized. Appendix A refers to the proposed Agreement between JPA members for cost sharing and responsibilities.

4.5 DIVISION OF RESPONSIBILITIES:

The Agreement between the JPA is provided in **Appendix A**.

The City of East Palo Alto is responsible for the construction of the Weir, Flood Wall Structure and Levee along the north bank of San Francisquito Creek on the San Mateo County side. The Santa Clara Valley Water District will be responsible for the construction of the Floodwall and Levee along the southbank of San Francisquito Creek on the Santa Clara County side.

While the JPA body as described above is responsible for the project, different JPA members are responsible for different components as illustrated below

Planning

Joint effort by the CPA, the CEPA, the CMP, the SMC and the District.

CEQA documents

Provided by the SMC
Appendix B refers to the Initial Study/Mitigated Negative Declaration.

Permits

Regulatory permits – Obtained by District
Construction permits – Divided between CEPA and the District

- Permits req'd for work in Palo Alto – The District
- Permits req'd for work in East Palo Alto – CEPA
  Exception – The District will obtain the Caltrans permit for work in East Palo Alto.

Engineering Design

Design work in Palo Alto – The District
Design work in East Palo Alto – Divided between CEPA and SCVWD

- The District will provide the levee design downstream of Hwy 101 in East Palo Alto
- The CEPA will provide the floodwall design upstream of Hwy 101 in East Palo Alto

Construction Administration

Construction administration in Palo Alto – The District
Construction administration in East Palo Alto – The CEPA

4.6 REGULATORY AGENCY ISSUES:

The District is responsible for securing all construction permits for the project.

The entire project is tidal. The creek is identified as a prized steelhead habitat throughout the project. The District will pursue permits to work from the bottom of the channel upstream of West Bayshore Road. All work downstream of Hwy 101 will be done from the existing levee tops to avoid damaging pickleweed and other environmentally sensitive habitat adjacent to the existing levees.

District staff will work closely with the California Fish & Game Department on construction techniques for the wall replacements upstream of Highway 101. Concrete debris will of be generated during the demolition of the existing 1958 sacked concrete wall that stretches approximately 1000 feet upstream of West Bayshore Road.

Preliminary permit applications have been sent to the CDFG, RWQCB and COE in March 2002. Formal application packages will be submitted following Board's adoption of the CEQA findings expected to occur on May 7, 2002. Two meetings were held with the agencies to describe the project details and obtain their comments. The reaction has been positive and no regulatory obstacles are expected. Staff expect to receive draft permits from all agencies by the end of May 2002, prior to the request for Board approval to award the construction contract.

4.7 REAL ESTATE ISSUES:

All real estate expenses in Santa Clara County will be borne by the District.

Construction work upstream of West Bayshore Road in Palo Alto will be staged in part from neighboring private backyards. Temporary and permanent easements must be acquired from 15 properties immediately upstream of West Bayshore Road. The temporary construction easements intrude 1 to 3 feet beyond the existing back yard fence lines in most cases. Permanent easement is necessary from all from 15 lots to allow necessary maintenance of the proposed new floodwall. The necessary Hazmat work will be completed for these easements.

SCVWD will acquire right-of-way upstream of Highway 101 for this project.

The requests for easement acquisition will be presented to the Board for approval on June 4, 2002.

4.8 SCHEDULE:

Currently, the District plans to begin construction in mid June, 2002 in order to utilize the 4 month window (June 15th to October 15th) when impacts to steelhead are minimized in the upstream portion of the project where channel bottom construction staging is desired.

Listed below is the schedule for advertisement and construction:

Board Date – Engineers Report	April 16, 2002
Public Hearing on Engineers Report & Adopt CEQA Findings	May 7, 2002
Board Date – Request for Construction Advertisement	May 7, 2002
Advertise for Construction	May 8, 2002
Board Date – Award Construction Contract	June 4, 2002
Notice to proceed	June 10, 2002
Complete work U/S of Hwy 101	June 15, 2002 to October 15, 2002
Complete project	December 1, 2002

SECTION 5

EFFECT OF PROPOSED PROJECT ON FUTURE BENEFIT COST CALCULATIONS FOR FEDERAL INTEREST IN A FLOOD DAMAGE REDUCTION PROJECT

The Corps of Engineers requires the use of risk-based analysis procedures for formulating and evaluating flood damage reduction measures. Risk-based analysis quantifies uncertainty in discharge-exceedance probability, stage-discharge, and damage-stage functions and incorporates it into economic and engineering performance analyses of alternatives.

The Corps uses a calculated Benefit-cost ratio to determine whether a project is feasible and should be pursued with Federal resources. The "benefit" of a flood damage reduction project is often referred to as expected damages under existing conditions. This is in reference to the flood damages that would be avoided by construction of a project, or the economic benefit of constructing the project.

In their 1961 Report for Flood Control and Allied Purposes on San Francisquito Creek, the Corps determined that feasible alternatives existed for providing flood damage reduction on San Francisquito Creek. Among the alternatives considered economically feasible were a multi-purpose dam at Ladera (on Stanford land, upstream of Highway 280) and, later, in their 1968 report, an underground diversion channel that would divert high flows from near El Camino Real and convey them to the Bay. The Corps then set about the long process of securing federal funding to pursue design and implementation of a project.

By about 1968, the local agencies were frustrated with the lack of protection for their citizens. Upon agreement of the San Francisquito Creek Committee, which represented Palo Alto, Menlo Park, East Palo Alto, San Mateo County and the Santa Clara Valley Water District; the two flood control agencies (SMC Flood and SCVWD) agreed to construct an interim, emergency flood protection project that would provide some interim protection between the Bayshore Bridge (highway 101) and Middlefield Road, while the long-term protection project was being designed and implemented by the Corps.

In 1969, a joint project was designed and constructed that lined much of the banks in that reach with sacked concrete, providing both bank stability and a smoother flow surface for flood relief. Also, low berms and concrete floodwalls, of varying qualities, were constructed along that reach to provide interim, emergency protection from overbanking.

In 1971, the Corps learned of these interim improvements and, despite the fact that the flood protection walls were not constructed to Corps standards, recalculated the statistical benefits (potential damages) due to flooding in the area. While the interim flood protection work did not provide protection to the 1% event, which was the intended goal of the Corps project, they did provide enough protection (damage reduction) so that the Corps' benefit-cost ratio was no longer greater than 1. A project could no longer be economically justified, and the Corps recommended that no project be authorized.

Today's Conditions

In 2000, when the "interim emergency project" of 1969 was over 30 years old, the Corps looked again at the economic feasibility of conducting flood control work on San Francisquito Creek. The Corps' Risk and Uncertainty analysis of March, 2000 looked at two conditions for expected damages under existing conditions. The study found:

i) Without-Project Condition I (without floodwall) – 8.9% Expected Annual Exceedance Probability (11-Year Event); assumes a worst case scenario that the existing flood control features fail. (refers to the potential failure of the aging flood control improvements emplaced in 1958 and 1969)
ii) Without-Project Condition II (with floodwall) - 6.7% Expected Annual Exceedance Probability (15-Year Event); assumes that the existing flood control features perform as intended with the target stage set at the top of the levee.

For this study, the Corps looked only at flooding in Palo Alto, because FEMA data was readily available to them after the recent restudy. The Study found:

The expected equivalent annual damage estimate for the Palo Alto reach (Palo Alto side of the creek only), under Without-Project Condition I, is $8.4 million. The expected equivalent annual damage estimate for Palo Alto reach, under Without-Project Condition II, is $5.9 million.

The purpose of the Corps' March 2000 Risk and Uncertainty Analysis Report was to look at the potential damages (benefits) from flooding, to determine on a very preliminary level whether the flood problem is substantial enough to look more closely and formulate alternative solutions. Their initial analysis showed that it is.

In light of what happened in 1972, regarding the Corps' finding that an interim project made a flood protection project economically infeasible, it is prudent to consider whether a similar occurrence would happen if the proposed project were constructed downstream of Highway 101. With the proposed improvements to the existing floodwalls, it is possible that these walls would no longer be considered "interim", and the Corps; base analysis would then revert to condition II as described above. Futhermore, because the height of the floodwalls would be raised under the proposed project, it is possible that the Corps would recalculate expected damages based on a new higher, stronger wall. The increased level of protection may serve to reduce the benefits of a future project, and make it less feasible for the Corps to participate (with associated Federal funding).

Calculating the reduction in risk and potential change in economic damages from the proposed levee project is beyond the scope of this study. Section 104 of the 1986 Water Resources Development Act provides general credit for flood control works constructed by local sponsors. The regulations may provide some guidance for proceeding and possibly negotiating with the Corps. Section 104 provides that local improvements initiated within 5 years before a Corps reconnaissance study can be incorporated into the recommended plan for the purpose of economic evaluation. However, credit can be considered only for local work undertaken after the end of the reconnaissance study.

SANTA CLARA VALLEY WATER DISTRICT

SAN FRANCISQUITO CREEK LEVEE PROJECT

FOOTBRIDGE TO 1400 FEET UPSTREAM OF HIGHWAY 101

VOLUME TWO

APPENDICES TO ENGINEER'S REPORT

Prepared by Hydraulic/General Civil Engineering Unit, Capital Program Services Division

Sara Duckler, P.E.	Associate Civil Engineer
Roy Weese, P.E.	Associate Civil Engineer
Parivash Gharib	Assistant Engineer II

Prepared Under the Direction of

Liang Lee, P.E.
Senior Project Manager

Walt Wadlow
Chief Operating Officer

Stanley M. Williams
Chief Executive Officer

March 2002

SANTA CLARA VALLEY WATER DISTRICT

SAN FRANCISQUITO CREEK LEVEE PROJECT

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March 2002

DISTRICT BOARD OF DIRECTORS

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Richard P. Santos	District 3	Sig Sanchez	At Large
Larry Wilson	District 4		

APPENDIX A

SAN FRANCISQUITO CREEK LEVEE PROJECT

PROPOSED AGREEMENT BETWEEN SANTA CLARA VALLEY WATER DISTRICT, SAN MATEO COUNTY FLOOD CONTROL DISTRICT, CITY OF EAST PALO ALTO, CITY OF PALO ALTO, CITY OF MENLO PARK FOR THE RECONSTRUCTION AND MAINTENANCE OF THE SAN FRANCISQUITO CREEK LEVEES

AGREEMENT

SAN FRANCISQUITO CREEK LEVEE PROJECT

Reconstruction and Maintenance of the San Francisquito Creek Levees Downstream of U.S. Highway 101

This AGREEMENT is entered into on ____________________, 2002, by and between Santa Clara Valley Water District, hereinafter called "WATER DISTRICT," the San Mateo County Flood Control District, hereinafter called "SAN MATEO," the City of East Palo Alto, hereinafter called "EAST PALO ALTO," the City of Palo Alto, hereinafter called "PALO ALTO," and the City of Menlo Park, hereinafter called "MENLO PARK" or collectively as "PARTIES" or generically as "PARTY".

WHEREAS the levees along San Francisquito Creek Downstream of U.S. Highway 101, hereinafter called "Levees" are intended to provide flood protection for the businesses and residents of EAST PALO ALTO and PALO ALTO,

WHEREAS said levees have subsided and do not provide the level of flood protection that the levees were intended to provide when the levees were built in 1958.

WHEREAS the reconstruction of said levees is in the best interest of PARTIES and will benefit the citizens and businesses within the general area of the levees.

WHEREAS the future maintenance of said levees is in the best interest of PARTIES and will benefit the citizens and businesses within the general area of the levees.

NOW, THEREFORE, PARTIES, for the consideration and upon the terms and conditions hereinafter specified, agree as follows:

RECONSTRUCTION OF LEVEES AND ASSOCIATED WORK

1. Project Description

A. The San Francisquito Creek Levee Project consists of "in part" the reconstruction to raise the levees on both sides of San Francisquito Creek from station 32+00, approximately 62 feet upstream of the pedestrian bridge, to station 77+87 at the downstream face of the U. S. Highway 101 bridge. The levees are to be raised to match the original top of levee elevations as constructed in 1958. Any portion(s) of the PALO ALTO bicycle path that is removed or damaged during the reconstruction of the levees shall be replaced in a manner approved by PALO ALTO. This portion of Project is hereinafter called "Levees."

B. The San Francisquito Creek Levee Project includes the replacement of or modifications to the existing flood wall along the south bank of San Francisquito Creek in Palo Alto upstream of the West Bayshore Road bridge from station 80+30 to station 91+00. The flood wall shall be raised to the elevation needed to preserve the water surface freeboard that existed prior to both the installation of Levee reconstruction described in the preceding paragraph and the construction of the Woodland Creek Apartments development in East Palo Alto. This portion of Project is hereinafter called "Floodwall."

C. The San Francisquito Creek Levee Project also includes a modification of the weir in the floodwall at the Woodland Creek Apartments and a new floodwall structure adjacent to the wingwall of the West Bayshore Road bridge upstream of Highway 101 along the north bank of San Francisquito Creek in EAST PALO ALTO. Both the weir modification and new flood control structure adjacent to the wingwall shall not exceed the design elevation of the floodwall on the opposite side of the creek in PALO ALTO. This portion of Project is hereinafter called "Weir and Flood Wall Structure."

D. Collectively, the raising of Levees, construction of Floodwall, Weir and Flood Wall Structure described in the preceding three paragraphs shall hereinafter be called " Project."

E. Each PARTY shall grant to all other PARTIES the rights to enter their property or easements along and adjacent to San Francisquito Creek and its levees downstream of U.S. Highway 101 for the purpose of constructing the Project.

2. WATER DISTRICT Project Responsibilities

A. WATER DISTRICT shall prepare construction drawings and specifications for the reconstruction of Levees and construction of Floodwall. WATER DISTRICT shall provide the other PARTIES opportunities to review and comment on the construction drawings before they are completed. WATER DISTRICT shall provide reproducible copies of the construction drawings and an electronic file of the specifications to EAST PALO ALTO.

B. WATER DISTRICT shall acquire, as co-permittee with EAST PALO ALTO the regulatory permits or waivers needed for the construction of Project from the California Department of Transportation, California Department of Fish and Game, California Regional Water Quality Control Board - San Francisco Bay Region, and United States Army Corps of Engineers.

C. WATER DISTRICT shall acquire any temporary construction and permanent rights of way or access needed for the construction of Levees and Floodwall along the south bank San Francisquito Creek in PALO ALTO.

D. WATER DISTRICT shall advertise for bids to select a contractor to construct Levees in PALO ALTO and Floodwall upstream of HWY. 101 in PALO ALTO. WATER DISTRICT shall perform the needed construction administration and inspection for the construction of Levees and Floodwall along the south bank of San Francisquito Creek, in PALO ALTO.

Advertising Project, selecting the contractor, construction administration and construction inspection shall be performed in accordance with WATER DISTRICT standard procurement and selection processes including bidding procedures where required or appropriate.

E. WATER DISTRICT shall require the construction contractor to name as additional insured on their Comprehensive/Commercial General Liability coverage "The Santa Clara Valley Water District, its directors on the board, officers, employees and agents, the San Mateo County Flood Control District, its supervisors on the board, officers, employees and agents, the City of East Palo Alto its council members, officers, employees and agents, the City of Palo Alto its council members, officers, employees and agents, and the City of Menlo Park its council members, officers, employees and agents."

3. EAST PALO ALTO Project Responsibilities

A. EAST PALO ALTO shall prepare construction drawings and specifications for the construction of Weir and Flood Wall Structure upstream of Highway 101 to an elevation not to exceed the top of the floodwall on the opposite side of the creek in PALO ALTO. EAST PALO ALTO shall provide the other PARTIES opportunities to review and comment on the construction drawings before they are completed.

B. EAST PALO ALTO shall acquire any temporary construction and permanent rights of way or permission to access needed for the construction of Weir and Flood Wall Structure upstream of Highway 101 and Levees downstream of Highway 101 in EAST PALO ALTO.

C. EAST PALO ALTO shall select a contractor and perform the needed construction administration for the construction of Levee in EAST PALO ALTO and Weir and Flood Wall Structure upstream of Highway 101 in EAST PALO ALTO in accordance with EAST PALO ALTO standard procurement and selection processes including bidding procedures where required or appropriate.

D. EAST PALO ALTO shall require the construction contractor to name as additional insured on their Comprehensive/Commercial General Liability coverage "The Santa Clara Valley Water District, its directors on the board, officers, employees and agents, the San Mateo County Flood Control District, its supervisors on the board, officers, employees and agents, the City of East Palo Alto its council members, officers, employees and agents, the City of Palo Alto its council members, officers, employees and agents, and the City of Menlo Park its council members, officers, employees and agents."

4. SAN MATEO Project Responsibilities

A. SAN MATEO shall develop and adopt the necessary environmental document that will meet the requirements of the California Environmental Quality Act (CEQA) for Project. This includes all biological or other assessments needed to complete the environmental document.

MAINTENANCE OF PROJECT

5. Maintenance Responsibilities

A. WATER DISTRICT shall be responsible for the maintenance of Floodwall upstream of Highway 101 and Levees downstream of Highway 101 along the south bank of San Francisquito Creek in PALO ALTO. The Levees shall be maintained to an elevation not less than one foot below the 1958 design elevations.

B. EAST PALO ALTO shall be responsible for the maintenance of Weir and Flood Wall Structure Highway 101 and Levees downstream of Highway 101 along the north bank of San Francisquito Creek in EAST PALO ALTO. The Levees shall be maintained to an elevation not less than one foot below the 1958 design elevations.

C. Each year EAST PALO ALTO and WATER DISTRICT shall inspect the project for deficiencies. Every three years, starting in 2005, EAST PALO ALTO and WATER DISTRICT shall survey the Levee elevations to determine subsidence. Maintenance work needed to maintain the designed level of flood protection or to protect the facility shall be identified during the inspections and surveys.

Maintenance work identified which does not result in a change of alignment, a restriction to stream flow, or an increase in the currently existing elevations, shall be considered routine maintenance. Routine maintenance includes but is not limited to vegetation management, erosion repairs/bank stabilization, repair of rodent or mitten crab holes or reconstruction of a damaged portion of Project to currently existing conditions. The PARTY responsible for that portion of the Project shall conduct independently the identified routine maintenance.

Maintenance work identified that will restore the facility to the design conditions of the Project, as designed in 2002, shall be considered restoration maintenance. Restoration maintenance includes, but is not limited to, work that results in a change of alignment, a restriction to stream flow, an increase in the current existing elevations, or sediment removal.

Once restoration maintenance is identified EAST PALO ALTO and WATER DISTRICT shall budget to have the restoration maintenance completed within the next 18 months. If either PARTY does not perform, within 18 months of the survey or inspection, the identified restoration maintenance on the portion of the project for which they are responsible, the other PARTY shall perform the restoration maintenance and shall invoice the delinquent PARTY.

D. Prior to performing routine maintenance on any portion of Project or performing sediment removal , the PARTY proposing to perform the maintenance shall notify all of the other PARTIES of the proposed work. The notification shall include a description of the proposed work, map showing the location of the work, and schedule for performing the work. Excluded from this notification requirement is minor work that includes such work as rodent eradication, rodent or mitten crab hole repairs, erosion repairs less than 100 feet in length, vegetation management, repairs to the bicycle trail or pedestrian bridge. Notification shall be mailed to the PARTIES at the addresses listed in the Notification paragraph, 30 days before the date of the proposed work. Such advance written notification is not required when emergency maintenance is required. In the case of an emergency, notification will be provided at the earliest possible time.

E. Each PARTY shall grant to all other PARTIES the rights to enter their property or easements along and adjacent to San Francisquito Creek and its levees downstream of U.S. Highway 101 for the purpose to performing the maintenance prescribed in this Agreement or for general inspection of the facilities.

FINANCIAL

6. Project Cost Sharing

A. The Project costs shall be divided between the portions of the Project constructed in EAST PALO ALTO and the portions of the Project constructed in PALO ALTO in the following manner:

North Bank Project Costs

1. Final Construction Cost for the portion of the Project along the north bank of San Francisquito Creek (North Bank Construction Costs) consisting of the construction of:
    A. Weir
    B. Flood Wall Structure
    C. Levee along the north bank of San Francisquito Creek

2. Construction Administration in for the portion of the Project along the north bank of San Francisquito Creek

3. Allocated Cost of the preparation work for the development and adoption of the CEQA document.

4. Allocated Cost of the preparation work for the Project planning, design, acquiring permits and developing the plans and specifications.

5. Temporary or permanent rights of way required for the construction of the Project along the north bank of San Francisquito Creek.

The allocated cost shall be based on the proportion of the North Bank Construction Costs to the final construction cost for the entire Project times the cost for the preparation work. The final construction cost is the sum of the North Bank Construction Costs and the South Bank Construction Costs.

South Bank Project Costs

1. Final Construction Cost for the portion of the Project along the south bank of San Francisquito Creek (South Bank Construction Costs) consisting of the construction of:
   - A. Floodwall
   - B. Levee along the south bank of San Francisquito Creek

2. Construction Administration for the portion of the Project along the south bank of San Francisquito Creek.
3. Allocated cost of the preparation work for the development and adoption of the CEQA document.
4. Allocated cost of the preparation work for the Project planning, design, acquiring permits and developing the plans and specifications.

5. Temporary or permanent rights of way required for the construction of the Project along the south bank of San Francisquito Creek.

The allocated cost shall be based on the proportion of the South Bank Construction Costs to the final construction cost for the entire Project times the cost for the preparation work. The final construction cost is the sum of the North Bank Construction Costs and the South Bank Construction Costs.

B. SAN MATEO shall act as the fiscal agent and shall advance all funds necessary for the preparation and adoption of the CEQA document and the construction of the Weir, Flood Wall Structure and Levee along the north bank of San Francisquito Creek.

1. EAST PALO ALTO shall pay to SAN MATEO $50,000.00 (fifty thousand dollars) towards the costs of the facilities constructed along the north bank of San Francisquito Creek.

2. MENLO PARK shall pay SAN MATEO $50,000.00 (fifty thousand dollars) towards the cost of the facilities constructed along the north bank of San Francisquito Creek.

3. WATER DISTRICT shall pay SAN MATEO for the costs allocated to the portion of the Project along the south bank of San Francisquito Creek for costs incurred by SAN MATEO for the preparation and adoption of the CEQA document.

4. SAN MATEO shall pay EAST PALO ALTO the full amount of the construction administration for the construction of the Weir, Flood Wall Structure and Levee along the north bank of the San Francisquito Creek.

5. EAST PALO ALTO shall pay for any Project-related permanent or temporary construction rights of way required along the north bank of San Francisquito Creek. This cost is not reimbursable and does not count toward the calculation of Final Project Cost.

6. All remaining costs will be paid by SAN MATEO.

C. WATER DISTRICT shall act as the fiscal agent and shall advance all funds necessary for the plans and specifications, acquiring permits and the construction of Floodwall and Levee along the south bank of San Francisquito Creek.

1. PALO ALTO shall pay to WATER DISTRICT $50,000.00 (fifty thousand dollars) towards the costs of the facilities constructed along the south bank of San Francisquito Creek.

2. PALO ALTO shall, in addition, pay WATER DISTRICT the actual costs for the removal and rebuilding the bicycle trail on the top of the reconstruction Levee along the south bank of San Francisquito Creek.

3. SAN MATEO shall pay WATER DISTRICT for the costs allocated to the portion of the Project along the north bank of San Francisquito Creek for costs incurred by WATER DISTRICT in preparation of the plans and specifications and acquiring permits.

4. WATER DISTRICT shall pay for any Project-related permanent or temporary construction rights of way required along the south bank of San Francisquito Creek. This cost is not reimbursable and does not count toward the calculation of Final Project Cost.

5. All remaining cost will be incurred by WATER DISTRICT.

D. Each PARTY shall make its obligated payments within 60 (sixty) days after an invoice is sent by the fiscal agent. The fiscal agent will submit the invoice following the final acceptance of the constructed Project from the contractor, and determination of the final construction cost.

7. Maintenance Cost

A. The cost for maintenance of Floodwall and Levees downstream of Highway 101 along the south bank of San Francisquito Creek, shall be borne entirely by WATER DISTRICT.

B. The cost for the maintenance of the Weir, Flood Wall Structure and Levees downstream of Highway 101 along the north bank of San Francisquito Creek, shall be borne entirely by EAST PALO ALTO.

GENERAL PROVISIONS

8. Term of the Agreement

Term of the Agreement shall be for a period of 25 years from the date identified above. As the maintenance of Levees, Floodwall Wall Structure,Weir and creek channel will be ongoing as long as the facilities are in existence, it is the intention of the PARTIES to revise this agreement on such terms and conditions as circumstances warrant.

9. Assignability

PARTIES agree that particular work assignments have been made in the interest of dividing the work up to complete the Project. Without the written consent of the other PARTIES, no PARTY shall assign or transfer any interest in this Agreement or any of the obligations hereunder except to contractors or consultants working directly for that PARTY. Any unauthorized attempt by any PARTY to so assign or transfer shall be void and of no effect. Any PARTY hiring a contractor or consultant shall be responsible for the inspection, review, and quality of all work of that contractor or consultant.

10. Structural Strength of Levee

The work on the Levee is for the purpose of returning the Levee to the design elevation as constructed in 1958 for the purposes of retaining flood flows within the San Francisquito Creek. The work on the Levee is not intended to provide any additional structural strength to Levee as it currently exists nor is it intended to provide flood protection greater than the 1958 levee design elevations provide.

11. Indemnification

Each PARTY shall defend, indemnify, and hold harmless all other PARTIES, its directors, council members, employees, and agents against any claim, loss or liability arising out of or resulting in any way from work performed under this Agreement due to the willful or negligent acts (active or passive) or omissions by that PARTY or it's directors, council members, employees, and agents.

12. Nondiscrimination

No PARTY shall discriminate, in any way, against any person in connection with or related to the performance of this Agreement because he/she is a veteran or because of a physical or mental disability (including HIV and AIDS), nor on the basis of race, color, religion, gender, national origin, ancestry, marital status, sexual orientation, age (over 40), medical condition (cancer) parental status, pregnancy, the exercise of family care leave rights, or political affiliation..

13. Termination

A. A PARTY shall have the right to terminate this Agreement, for cause, by giving not less than a one year written notice of termination to all of the other PARTIES.

B. If any PARTY fails to perform any of its material obligations under this Agreement, in addition to all other remedies provided by law, any other PARTY may terminate this Agreement immediately upon written notice.

C. The City Manager of EAST PALO ALTO, the City Manager of PALO ALTO, the City Manager of Menlo Park, the Chief Executive Officer of WATER DISTRICT, and the County Manager of SAN MATEO, are empowered to terminate this Agreement on behalf of their respective agencies.

D. In event of termination, each PARTY shall deliver to all of the other PARTIES, upon request, copies of reports, documents, and other work performed by any PARTY under this Agreement. The cost of work performed under this agreement to the date of termination shall be due and payable in accordance with provision 6 (Cost Sharing).

14. Governing Law and Compliance with Laws

PARTIES agree that California law shall govern this Agreement. In the performance of this Agreement each PARTY shall comply with all applicable laws, ordinances, codes and regulations of the federal, state, and local government.

15. Ownership of Materials

All reports, documents, or other materials developed or discovered by any PARTY or any other person engaged directly or indirectly by any PARTY to perform the services required hereunder shall be and remain the mutual property of all PARTIES without restriction or limitation upon their use.

16. Notification

Any and all notices or other communications required to be given hereunder shall be deemed to have been delivered upon deposit in the United States mail, postage prepaid, addressed as specified below or as later amended by the PARTY in writing:

East Palo Alto

City of East Palo Alto
2200 University Avenue
East Palo Alto, California 94303
Attn.:

Palo Alto

City of Palo Alto
250 Hamilton Avenue
Palo Alto, California 94303
Attn.: City Manager

San Mateo

San Mateo County
555 County Center, 5th Floor
Redwood City
Attn.: Neil R. Cullen

Water District

Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, California 95118-3614
Attn.: Stanley Williams

Menlo Park

City of Menlo Park
701 Laurel Street
Menlo Park, CA 94025-3483
Attn: City Manager

17. Successors and Assigns

This Agreement, and all the terms, covenants, and conditions hereof, shall apply to and bind the successors and assigns of the respective PARTIES hereto.

18. Signing by Counterpart

This Agreement may be signed in counterpart and each signed document shall constitute the whole as if a single document was signed by all PARTIES.

19. Venue

In the event that suit shall be brought by any PARTY to this contract, the PARTIES agree that venue shall be exclusively vested in the state courts of either the County of Santa Clara, or the County of San Mateo or where otherwise appropriate, exclusively in the United States Court, Northern District of California, in either Redwood City or San Jose, California.

20. Prior Agreements and Amendments

This Agreement represents the entire understanding of the PARTIES as to those matters contained herein. No prior or written understanding including the September 1958 agreement between San Mateo County and the Santa Clara County Flood Control District shall be of any force or effect with respect to those matters covered hereunder. This Agreement may only be modified by a written amendment duly executed by all PARTIES to this Agreement.

CITY OF EAST PALO ALTO	**CITY OF PALO ALTO**
By: ____________________ City Manager	By: ____________________ City Manager
Date:___________________	Date:___________________
ATTEST:	ATTEST:
____________________ City Clerk	____________________ City Clerk
APPROVED AS TO FORM	APPROVED AS TO FORM
____________________ City Attorney	____________________ City Attorney
SAN MATEO COUNTY FLOOD CONTROL DISTRICT	**SANTA CLARA VALLEY WATER DISTRICT**
By: ____________________	By: ____________________

Jerry Hill
President, Board of Supervisors

Date:____________________

ATTEST:

____
County Clerk

APPROVED AS TO FORM

____
County Counsel

Stanley M. Williams
Chief Executive Officer

Date:____________________

APPROVED AS TO FORM

____
Anthony C. Bennetti
General Counsel

CITY OF MENLO PARK

By: ____________________
David Boesch
City Manager

Date:____________________
ATTEST:

____
City Clerk

APPROVED AS TO FORM

____
City Attorney

APPENDIX B

SAN FRANCISQUITO CREEK LEVEE PROJECT

Initial Study and Mitigated Negative Declaration

Public Review Draft

San Francisquito Creek Levee Restoration and Floodwall Reconstruction Project

Initial Study and Mitigated Negative Declaration

Prepared for
San Mateo County Flood Control District
Department of Public Works

Prepared by
Thomas Reid Associates
560 Waverley Street, Suite 201
Palo Alto, CA 94301
650.327.0429
650.327.4024 fax
www.traenviro.com

March 2002

Mitigated Negative Declaration

DATE: March 15, 2002
SUBJECT: Mitigated Negative Declaration

Pursuant to the California State Public Resources Code and the California Environmental Quality Act (CEQA) Guidelines, as amended to date, the San Mateo County Flood Control District (District) submits a Mitigated Negative Declaration for the San Francisquito Creek Levee Restoration and Floodwall Demolition and Reconstruction Project (Project).

PROJECT OVERVIEW

The project has two components: Levee Restoration and Floodwall Demolition and Reconstruction. Each of these components is described below. San Francisquito Creek functions as a dividing line between San Mateo and Santa Clara Counties. The Santa Clara Valley Water SCVWD (SCVWD) is responsible for construction on the Santa Clara County side and the City of East Palo Alto is responsible for construction on the San Mateo County side. The San Francisquito Creek Joint Powers Authority (JPA) is coordinating the project.

The project objective is to increase flood flow capacity within San Francisquito Creek by restoring the levees downstream of Highway 101 to their as-built 1958 elevation, and by rebuilding an 1100 foot section of floodwall in Palo Alto and closing a weir and "CALTRANS gap" on the East Palo Alto side upstream of Highway 101. The city of Palo Alto's bike path on top of the levee will also be removed and rebuilt in the process.

This project restores the San Francisquito Levee to its 1958 as-built elevation, but does not address protection for the 100-year flood. The JPA is working with the U.S. Army Corps of Engineers to develop a long term plan that will address the 100-year flood.

Levee Restoration

The levee restoration portion of the project is located downstream of Highway 101 and will occur on both sides (banks) of the creek. The length of the restoration is approximately 4,500 feet long on each side, extending from approximately station 77+00 downstream to approximately station 32+00 where a pedestrian bridge exists. The project consists of adding up to 2.64 (vertical) feet of earthen material to the top of the existing levees to restore the levee elevations to the original 1958 design elevations.

The purpose of the levee restoration is to increase the current level of flood protection adjacent to the creek through restoration of the levee to its original height.

The levee restoration does not involve sediment removal or any other work within the San Francisquito channel bottom nor does it involve any work below the Ordinary High Water line.

Floodwall Demolition and Reconstruction

The Floodwall Demolition And Reconstruction portion of the project is located directly upstream of Highway 101, on both sides of the creek. The East Palo Alto (San Mateo County)n side of the creek currently has a Caltrans wingwall that exists directly upstream of the West Bayshore bridge for the first 70-75 feet. The proposed floodwall will be built within this reach, between the existing wingwall and the adjacent Woodland Creek development. The project area is from approximately station 80 + 00 to 80 + 75, and from approximately station 90 + 20 to 91 +30. No work will occur from stations 80 + 75 to 90 + 20. A new floodwall will be constructed where the existing wier is located.

The length of repair is approximately 1370 feet long. It extends upstream from the West Bayshore/Highway 101 bridge from approximately station 80+30 to approximately station 94+00. The first 1,070 feet of the floodwall will be removed and reconstructed with a formed concrete wall that will be approximately 12" in width and 2.3 to 5.2 feet in height. For the next 300 feet, from approximately station 91+00 to approximately 94+00, additional height increases of approximately 6 inches will be accomplished by adding one layer of sacked concreter to the existing sacked concrete floodwall. The existing wall will not be added to or modified upstream of station 94+00.

The project is proposed to take place within the channel bottom; this decision will be finalized after consultation with the regulatory agencies (California Department of Fish and Game, San Francisco Bay Regional Water Quality Control Board, and the U.S. Army Corps of Engineers).

FINDINGS

The District, having reviewed the Initial Study for the proposed project, consisting of the attached Initial Study, finds that:

1. The proposed project will reduce the potential of flooding adjacent to San Francisquito Creek downstream of U.S. Highway 101.

2. The restoration of the levees will increase the flood stage water surface elevation upstream of U.S. Highway 101 reducing freeboard protection. The project will mitigate for this loss of freeboard by replacing a portion of the floodwall on the Palo Alto side of the creek. It has been determined that the new Woodland Creek Apartments are not impacted in the same manner and will not be raised.

3. The project will not have adverse impacts on endangered species or species of special concern or status.

   San Francisquito Creek is critical habitat for the federally threatened Central California Coast Steelhead Evolutionary Significant Unit (ESU). The construction of the project within the stream channel will not start until after June 15 and shall end by October 15 to avoid the steelhead migration season.

   Potential habitat (pickleweed) for the salt marsh harvest mouse, an endangered species, has been identified in the vicinity of the portion of the project closest to San Francisco Bay. A survey of the area did not find any mice however; the project has been designed to avoid any impacts to salt marsh harvest mouse habitat.

   The project work area does not include any pickleweed habitat. The adjacent areas which have pickleweed habitat near the project area will be fenced with orange plastic fencing to ensure construction vehicles or personnel do not "wander" into the pickleweed and disturb the habitat.

   Marsh gum plant, a special status plant, was found growing in the pickleweed habitat on the inside of the levees. Protection of the pickleweed habitat with orange plastic fencing will also protect the marsh gum plant.

4. In addition to the mitigation measures in #2 and #3 above, the design features of the project which include mitigation measures and Best Management Practices (BMPs) directly incorporated into the project description either avoid, minimize, or reduce environmental effects to a point of less-than-significance; and

5. A Mitigated Negative Declaration will be filed as the appropriate CEQA document of the Project.

BASIS OF FINDINGS

Based on the environmental evaluation presented herein, the Project will not cause significant adverse effects related to aesthetics, agricultural resources, cultural resources, geology/soils, hazards and hazardous materials, land use/planning, mineral resources, population/housing, public services, recreation, transportation/traffic, and utilities/service systems. In addition, substantial adverse effects on humans, either direct or indirect, will not occur. The Project does not affect any important examples of the major periods of California prehistory or history. Nor will the Project cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal.

Along with the designs of individual activities, BMPs incorporated into the project descriptions for the Project avoid, minimize, and reduce impacts to air quality, biological resources, including fisheries, hydrology/water quality, and noise to less-than-significant levels. In addition, specific mitigation measures have been imposed to mitigate for cumulative wetlands, impacts, assumed to be significant.

Based on the Initial Study, the project designs and incorporated BMPs avoid, minimize, and reduce impacts to biological resources to a less-than significant level.

The Project mitigates the exposure of people and property to existing flood hazards by restoring channel capacity and repairing levees.

Attached is the Initial Stdy prepared for the Project. The public can review documents used in preparation of the Initial Study at San Mateo County Flood Control District, Department of Public Works, 555 County Center, 5th Floor, Redwood City, California 94063-1665; Attn: Walt Callahan.

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SECTION 1. INTRODUCTION

This section describes the purpose of an Initial Study (IS), the decision process to prepare a Negative Declaration (ND) or a Mitigated ND, a brief description and objectives of the San Francisquito Creek Levee Restoration and Floodwall Demolition and Reconstruction Project (Project), and a short discussion on other public agencies whose approval is required through the permitting process or who have an interest in the project.

1.1 PURPOSE OF THE INITIAL STUDY

This IS has been prepared by the San Mateo County Flood Control District (District), the Lead Agency for the project. The IS has been prepared pursuant to the California Environmental Quality Act (CEQA) for the Project. CEQA lists seven purposes of an IS [CEQA Guidelines 15063(c)]:

1. Provide the Lead Agency with information to use as the basis for deciding whether to prepare an Environmental Impact Report (EIR) or a Negative Declaration (ND).
2. Enable a Lead Agency to modify a project, mitigating adverse impacts before an EIR is prepared, thereby enabling the project to qualify for a ND.
3. Assist in the preparation of an EIR, if one is required.
4. Facilitate environmental assessment early in the design of a project.
5. Provide documentation of the factual basis for the finding in a ND that a project will not have a significant effect on the environment.
6. Eliminate unnecessary EIRs.
7. Determine whether a previously prepared EIR could be used with the project.

1.2 DECISION TO PREPARE A NEGATIVE DECLARATION OR MITIGATED NEGATIVE DECLARATION

According to CEQA Guidelines Section 15070, a public agency shall prepare a proposed ND or a Mitigated ND when:

1. The IS shows that there is no substantial evidence, in light of the whole record before the agency, that the project may have a significant effect on the environment, or
2. The IS identifies potentially significant effects, but:

Revisions in the project plans made before a proposed Mitigated ND and IS are released for public review would avoid the effects or mitigate the effects to a point where clearly no significant effects would occur, and

There is no substantial evidence, in light of the whole record before the agency, that the project as described may have a significant effect on the environment.

1.3 PROJECT OVERVIEW

The project has two unique components: Levee Restoration And Floodwall Demolition And Reconstruction. Each of these components is described below. San Francisquito Creek functions as a dividing line between San Mateo and Santa Clara Counties. The Santa Clara Valley Water District (SCVWD) is responsible for construction on the Santa Clara County side and the City of East Palo Alto is responsible for construction on the San Mateo County side. The San Francisquito Creek Joint Powers Authority (JPA) is coordinating the project.

The project objective is to restore some flood flow capacity within San Francisquito Creek before the winter of 2003 by restoring the levees downstream of Hwy 101 to their as-built 1958 elevation, and by rebuilding an 1100-foot section of floodwall in Palo Alto, and closing the weir and CALTRANS gap on the East Palo Alto bank upstream of Hwy 101. The city of Palo Alto's bike path on top of the levee will also be rebuilt in the process.

LEVEE RESTORATION

The Levee Restoration portion of project is located downstream of Highway 101 and will occur on both sides (banks) of the creek. The length of the restoration is approximately 4,500 feet long on each side, extending from approximately station 77+00 downstream to approximately station 32+00 where a pedestrian bridge exists. The project consists of adding up to 2.64 (vertical) feet of earthen material to the top of the existing levees to restore the levee elevations to the original 1958 design elevations. The purpose of the Levee Restoration project is to increase the current level of flood protection adjacent to the creek through restoration of the levee to its original height.

FLOODWALL DEMOLITION AND RECONSTRUCTION

Within the City of Palo Alto, the Floodwall Demolition and Reconstruction portion of the project is located directly upstream of Highway 101, on the Santa Clara County (southern) side of the creek. The length of repair is approximately 1370 feet long. It extends upstream from the West Bayshore/Highway 101 bridge from approximately station 80+30 to approximately station 94+00. The first 1,070 feet of the floodwall will be removed and reconstructed with a formed concrete wall that will be approximately 12" in width and 2.3 to 5.2 feet in height. For the next 300 feet, from approximately station 91+00 to approximately 94+00, additional height increases of approximately 6 inches will be accomplished by adding sacked concrete to the existing sacked concrete floodwall. The existing wall will not be added to or modified upstream of station 94+00.

Within the City of East Palo Alto, the Floodwall Demolition and Reconstruction portion of the project is also located just upstream of Highway 101, on the San Mateo County (northern) side of San Francisquito Creek. This side of the creek has a Caltrans wingwall that exists directly upstream of the West Bayshore bridge for the first 70-75 feet. The proposed floodwall will be built within this reach, between the existing wingwall and the adjacent Woodland Creek development. The project area is from approximately station 80 + 00 to 80 + 75, and from approximately station 90 + 20 to 91 +30. No work will occur from stations 80 + 75 to 90 + 20. A new floodwall will be constructed where the existing wier is located.

Within the City of Palo Alto, the Floodwall Demolition and Reconstruction portion of the project is proposed to be conducted from the creek bottom, to facilitate access and to preserve existing vegetation, including riparian plant material. A temporary earthen ramp would be constructed into the bottom of the channel at the intersection of West Bayshore Road and the Creek. Coffer dams will be constructed both upstream and downstream of the floodwall location

[redacted]

If the work is permitted to be constructed from the bottom of the channel, a easement of 6 feet would be required for the floodwall construction from residents in Palo Alto. This easement will consist of 3 feet of permanent easement beyond the outboard face of the new floodwall and 3 additional feet of a Temporary Construction Easement (TCE) beyond that. Alternately, if construction is done from the top of bank the working space is 3 feet of permanent easement plus 12 feet of TCE, for a total of 15 feet.

1.4 REGULATORY REQUIREMENTS

The following section summarizes agencies that have or may have permit or review authority over the proposed project.

1.4.1 U. S. Army Corps of Engineers (Corps)

The U. S. Army Corps of Engineers (Corps) regulates discharges of dredged or fill material into waters of the U. S., which includes wetlands, under Section 404 of the Clean Water Act and under Section 10 of the Rivers and Harbors Act. Two types of permits exist under Section 404: individual and general. Nationwide permits (NWPs) are a type of general permit issued for a suite of activities found to have a minimal effect on the environment by the Corps. If an activity has more than minimal effect or does not fit the parameters of a certain NWP, then the Corps issues an individual permit.

A Corps permit will be required for the proposed project for the portions of the project within Corps jurisdiction (below the "ordinary high water line.") Mitigation Measures and Best Management Practices (BMPs) as listed in this document will be used to ensure that no significant impacts to wetlands, biological resources and hydrology within Corps jurisdiction will occur.

1.4.2 U. S. Fish and Wildlife Service / National Marine Fisheries Service

The U. S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) implement and enforce the Endangered Species Act (ESA) of 1973 as amended. Under the ESA, it is unlawful to "take" listed species of plants and animals. Take is defined as: "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect . . . or to engage in any such conduct." USFWS have also defined take to include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter.

Consultation with NMFS, if requested by the Corps, may be required prior to project implementation due to potential presence of federally listed endangered species in the vicinity, as further discussed in the Environmental Checklist and Responses Section of this document, Biological Resources.

1.4.3 California Regional Water Quality Control Board (RWQCB)

The Environmental Protection Agency has designated the California Regional Water Quality Control Boards (RWQCB) to have the authority under Section 401 of the Clean Water Act to waive or certify activities subject to the Corps jurisdiction for water quality impacts. RWQCBs also have authority under the state Porter-Cologne Act to regulate waste discharges affecting waters of the state. State waters are defined as "any water, surface or underground, including saline waters, within the boundaries of the State" (Porter-Cologne Act). Based on this definition, wetlands water quality control is within the RWQCB jurisdiction (SF Bay).

The proposed project will require a Waiver of Waste Discharge to serve as a 401 Certification from the RWQCB.

1.4.4 California Department of Fish and Game (CDFG)

If an activity diverts, obstructs, or changes the natural flow or the bed, channel, or bank of any river, stream, or lake, in which there are at any time an existing fish or wildlife resource or from which these resources derive benefit or if an existing fish or wildlife resource may be substantially adversely affected, the California Department of Fish and Game (CDFG) requires notification. CDFG can issue individual "Streambed Alteration" agreements (commonly referred to as a "1601") from the applicable section in the CDFG code to public agencies (a "1603" is issued to private parties). CDFG also can develop, in concert with an applicant, a Memorandum of Understanding (MOU). The Santa Clara Valley Water District has two MOUs for stream maintenance with CDFG: one for unimproved channels and one for improved channels.

The Project will require a Section 1601 Steambed Alteration permit.

1.4.5 San Francisco Bay Conservation and Development Commission (BCDC)

The San Francisco Bay Conservation and Development Commission (BCDC) is responsible for carrying out the Bay Plan, a comprehensive plan with a goal of conserving the water of the San Francisco Bay, and regulating shoreline development. Policies include preventing and precluding bay fill, promoting public access, and reserving areas for water-oriented activities. BCDC jurisdiction includes the San Francisco Bay, including a 100-foot shoreline band, certain tidal portions of creeks, historic bay lands and salt ponds. Routine maintenance activities, including sediment removal and bank stabilization, are authorized under the SCVWD's BCDC permit # M77-13.

BCDC's jurisdiction begins about 5,000 feet downstream of the Highway 101 bridge, (past the Pedestrian bridge, which is the downstream terminus of the project.) Therefore, the project will not require a BCDC permit.

1.5 SAN FRANCISQUITO CREEK JOINT POWERS AUTHORITY

The JPA was formed in 1999 to address flooding and maintain San Francisquito Creek. The purposes of the JPA are:

1. To facilitate and perform bank stabilization, channel clearing, and other creek maintenance;
2. To plan flood control measures for the San Francisquito Creek watershed;
3. To take actions necessary to preserve and enhance environmental values and instream uses of San Francisquito Creek;
4. To coordinate emergency mitigation and response activities relating to San Francisquito Creek;

5. To make recommendations to Member Entities for funding and alternatives for long-term flood control for Member Entity consideration. (City of Palo Alto web site; http:/www.city.palo-alto.ca.us/jpa/, December 21, 2000)

The JPA was created through the adoption of a joint powers agreement by the member agencies, and is funded through contributions by its member agencies. The JPA consists of the cities of Palo Alto, East Palo Alto, and Menlo Park; the San Mateo County Flood Control District; and the Santa Clara Valley Water District. Associate members are Stanford University and the San Francisquito Watershed Council (formerly CRMP). The design and physical construction of the proposed project is being completed by member agencies, the Santa Clara Valley Water District (SCVWD) and the City of East Palo Alto, with coordination of the JPA.

1.6 REPORT ORGANIZATION

Section 2.0 describes the project location, environmental setting, and elements of the proposed Levee Restoration and Floodwall Demolition and Reconstruction project, including best management practices to avoid, minimize, or reduce impacts to a less-than-significant level. Section 3.0 is the Environmental Checklist, complete with answers to the Checklist that determine the level of effect. This section also contains any mitigation measures that will reduce stated impact to less than significant levels. Section 4.0 presents a mitigation monitoring program for mitigation measures identified in this document. Section 5.0 lists persons who contributed to the preparation of this document, and Section 6.0 lists references used in the preparation of this document.

Section 2. Project Location And Description

2.1 PROJECT LOCATION AND SETTING

2.1.1 Project Location

The portion of San Francisquito Creek within the project area is located on the northwestern boundary of Santa Clara County and the southern boundary of San Mateo County (see Figure 1). The creek establishes the boundary between Santa Clara and San Mateo Counties. This portion of the creek is within SCVWD's Lower Peninsula Watershed and the District's San Francisquito Creek Flood Control Zone. In the vicinity of the project, the creek also forms the boundary between the Cities of Palo Alto and East Palo Alto. Sufficient easement is owned by the partnering agencies to repair the levee. Easements are being secured from 15 private property owners behind the floodwall on the Palo Alto side of the Creek upstream of Highway 101. On the East Palo Alto side, downstream of Highway 101, an easement will be secured from one property owner.

The San Francisquito Creek watershed basin covers approximately 45 square miles and extends from Skyline Boulevard on the ridge of the Santa Cruz Mountains to the San Francisco Bay. Most of the watershed is located in San Mateo County with Los Trancos and San Francisquito Creeks forming the county line. Felt Lake and Searsville Lake are large impoundments within the watershed.

Figure 2 shows the Levee Restoration and Floodwall Reconstruction project sites. These are in the lower reaches of the San Francisquito Creek. These project sites are within the cities of East Palo Alto and Palo Alto. The entire project reach is approximately 6,200 feet long (including HWY 101), extending from the pedestrian bridge at approximately station 32+00 to approximately 1,370 feet upstream of Highway 101 at approximately station 94+00. From the downstream end of the project, San Francisquito Creek continues on for another 3,200 feet before it discharges into the southern San Francisco Bay.

Stationing begins at the mouth of San Francisquito Creek, at 0+00, where the creek enters San Francisco Bay, and each one of the numbers represents 100 feet (i.e., the distance between station 32+00 and 33+00 is 100 feet.)

2.1.2 Environmental Setting

The portion of the creek that is within Palo Alto City Limits is in SCVWD's Lower Peninsula Watershed, and the portion of the creek that is within East Palo Alto City Limits is in the District's San Francisquito Creek Flood Control Zone.

No special-status plant or animal species were found in the Levee Restoration project area (between Hwy 101 and San Francisco Bay) during reconnaissance-level surveys by Santa Clara Valley Water SCVWD biologists (Ryan and Falco 1998). No special status species were found in the Floodwall Demolition and Reconstruction project area (upstream of Hwy 101). Thomas Reid Associates biologists resurveyed the floodwall and levee areas in November 2001. During this survey, a special status plant, marsh gum plant (*Grindelia stricta angustifolia*) was found growing in the pickleweed habitat on the inside of the levees. This plant is listed by the California Native Plant Society on the watch list (CNPS 4) which means that the marsh gum plant is a plant of limited distribution.

San Francisquito Creek is critical habitat for the federally threatened Central California Coast Steelhead Evolutionary Significant Unit (ESU). Habitat for the salt marsh harvest mouse

FIGURE 1 – Regional Location

FIGURE 2: Vicinity Location

is present on both sides of the San Francisquito Creek (H.T. Harvey, 2001). See discussion in Section 3 for information on the effects of the proposed project on these sensitive species.

LEVEE RESTORATION

The entire Levee Restoration portion of the project is tidally influenced, although the upper portion receives tidal flow only at higher tides. Within the project limits downstream of Highway 101, the creek is contained within earthen levees, and has a bottom width ranging from 30 to 60 feet with slopes that vary between 1:1 and 3:1. There is a maintenance road on top of the levee on both sides of the creek for the entire length of the Levee Restoration project site. The pathway on the top of the levee on the Santa Clara County side is part of a regional Baylands Nature Preserve path system within the City of Palo Alto and also links to paths in San Mateo County. This bike path is part of the San Francisco Bay Trail. A storm drainage pump station facility is located on the western side of the creek within the City of East Palo Alto near the pedestrian bridge at the downstream end of the project site.

Photo 1-- This photo shows the levee restoration project, with the northern levee (San Mateo County) at photo left. The closest residences in East Palo Alto are to the right of this levee.

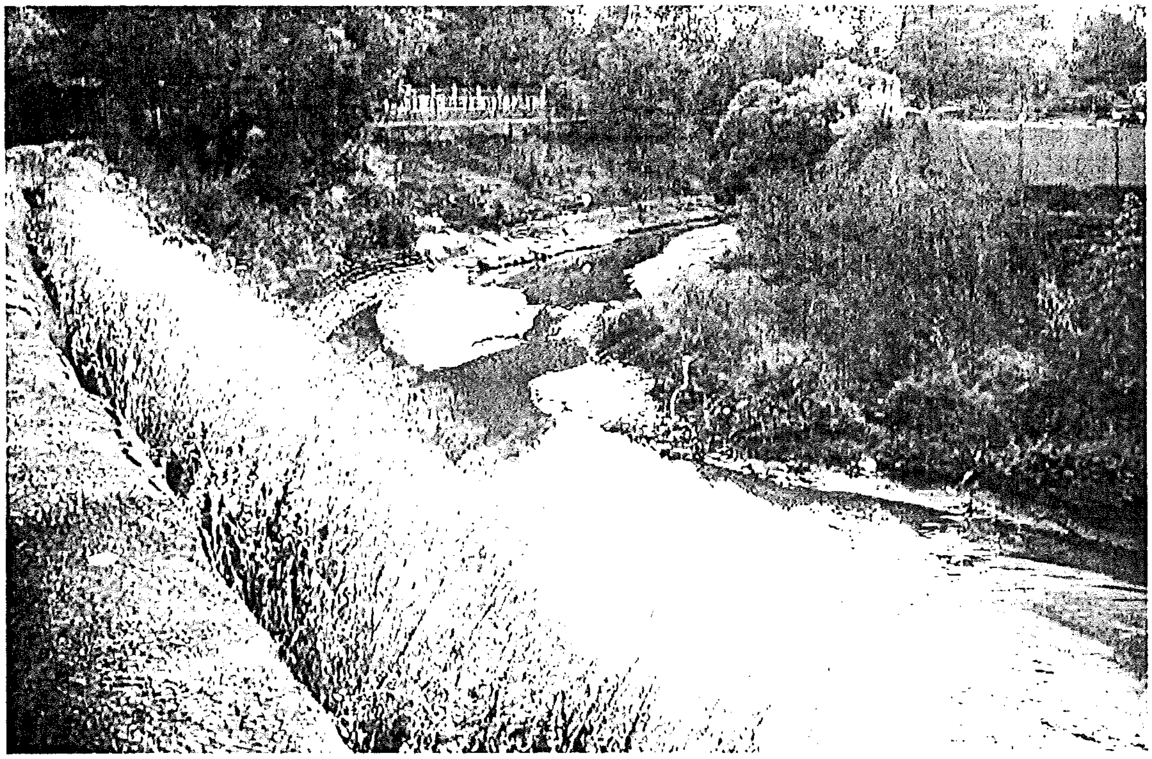
Downstream of Highway 101, single-family residential uses exist primarily on the San Mateo County side of the creek within the city of East Palo Alto, with a commercial storage unit at East Bayshore Road, adjacent to the eastern side of Highway 101. On the Santa Clara County side at this location, a mix of commercial and recreational uses is located within the city of Palo Alto. Commercial uses, including an International School, an auto body repair shop and a landscaping material yard are found near Highway 101 and East Bayshore Road. Moving downstream, the creek is bordered by Baylands Athletic Center and the 18-hole Palo Alto Municipal Golf Course.

The Palo Alto Airport and the City of Palo Alto's 1,940-acre Baylands Nature Preserve are located below the pedestrian bridge.

Floodwall Demolition and Reconstruction

Upstream of Highway 101, the portion of the creek within the project area is contained by an existing floodwall on the City of Palo Alto side of the creek. On the City of East Palo Alto side of the creek, a recently constructed three-story multi-unit residential development (Woodland Creek) has both floodwalls and a weir that are slightly below the existing grade of the development. San Francisquito Creek passes through a triple box culvert under Highway 101. Ownership of the lands adjacent to San Francisquito Creek extends to the Creek's centerline. The easement needed for the floodwall portion of the project within the City of East Palo Alto is owned by one landowner (Woodland Creek). The easement needed for the floodwall portion of the project within the City of Palo Alto is owned by 15 residents.

Existing land uses adjacent to the project site include a mix of residential, commercial, recreational and open space uses within the cities of Palo Alto (in Santa Clara County) and East Palo Alto (within San Mateo County). Highway 101 is a major transportation corridor in the vicinity that is bordered on each side by East and West Bayshore Roads.



2.1.3 Maintenance History

Sediments have built up in the channel over the years, with sediment benches forming along the inside of the channel at the elevation approximating the mean high water (approximately 4 to 5 feet Mean Sea Level [MSL].) Sediment was removed from San Francisquito Creek in the area directly downstream of Highway 101 in 1984 (3,290 cubic yards [cy]), 1993 (1,260 cy), 1997 (4,600 cy), and 2000 (4,000 cy.) During the winter of 1997- 1998, additional sediment was removed in the same area on an emergency basis on two occasions (a total of 1,500 cy). Additional maintenance activities consist of periodic vegetation control and infrequent levee erosion control.

2.2 PROJECT DESCRIPTION

2.2.1 Project Purpose and Need

The channel and earthen levees in the Levee Restoration area were constructed in 1958 in a cooperative effort between San Mateo County and the Santa Clara County Flood Control and Water Conservation District to provide flood protection (the Santa Clara County Flood Control District was the predecessor of the SCVWD.) The levees are no longer at their 1958 "As-Built" elevations due to land subsidence, settlement and erosion. The channel contains significant deposits of sediment, both from upstream sediments transported downstream and tidal action from San Francisco Bay. A combination of increased siltation of the channel and settlement of the levees has resulted in a decrease in channel capacity. The levee elevations have decreased by .65 – 2.64 feet from their originally constructed condition.

The existing floodwall (upstream of Highway 101 on the City of Palo Alto side of the creek) from 80 + 30 to 91+ 00 was intended to be temporary and is constructed of sacked concrete, held in place by vertical reinforcing bars. This portion of the wall was constructed in 1958 and was covered with shotcrete in the 1960s. The floodwall from station 91 +00 upstream was constructed in 1969. Work on the East Palo Alto side is proposed to provide increased flood protection as a result of the Levee Restoration project.

The levees and the floodwall no longer provide the level of flood protection for which they were designed. Lower levee heights and increased sedimentation have reduced the capacity of the channel from the designed condition. In addition, the reinforcing bars in the floodwalls are corroding, and therefore not able to provide the necessary structural stability. Thus, the risk of flooding to homes and businesses adjacent to these flood control features along San Francisquito Creek has increased. In February of 1998, the Levee Restoration project area experienced significant damage in several locations. In February 2000, the project area sustained top-of-levee flow with minor flooding.

The project to restore levees to their original elevations was proposed by the SCVWD and considered a Priority Project by the JPA in May 2000. The proposed project is to restore the levees to their originally constructed (as-built) elevations to increase the level of flood protection to the area downstream of Highway 101 and to mitigate the reduction in freeboard in the area upstream of Highway 101 which will be caused by the Levee Restoration. Adding compacted and reinforced earth fill to the top of the existing earth levees downstream of Highway 101 and increasing the existing floodwall height in the area upstream of Highway 101 will accomplish the objective.

The project to demolish the existing floodwall and build another is proposed by the SCVWD. This floodwall is necessary to provide the same level of flood protection as afforded by the 1958 construction because raising the levees raises the water surface elevation during flooding upstream. The Floodwall Demolition and Reconstruction project will also compensate for the rise in water surface elevation caused by recent development on the East Palo Alto side of the creek. The proposal is to conduct all work activities in the creek during the summer dry season, during June 15 to October 15. SCVWD hopes to conduct the floodwall demolition and reconstruction project from the bottom of the creek channel.

There are many advantages to conducting all of the activities from the creek bottom, including

- Fewer trees removed or cut back
- Reduced noise

- Reduced impacts to residents
- Less right-of-way required
- Better construction access
- Faster construction

The disadvantages are:

- Potential of compaction of the creek gravels
- Noise of pumps during off work hours (they will be running 24 hours a day)
- Short-term disruption of the tidal flows in this area

2.2.2 Project Characteristics

As stated above, the project consists of two main components: Levee Restoration and Floodwall Demolition And Reconstruction. Restoration of the levees will be accomplished with the addition of earth material to the top of the existing levees, to restore them to the original 1958 design elevation. The city of Palo Alto's bike path on top of the levee will also be rebuilt in the process. Upstream of Highway 101, the existing floodwall will be replaced from Station 80+30 to 91+00. A newer section of floodwall, built in 1969, will have an additional layer of sacked concrete added between station 91+00 and 94+00. This involves adding approximately 0.65 to 2.64 feet of vertical height to the existing or modified floodwall and closing the weir and CALTRANS gap on the East Palo Alto side of the creek upstream of Hwy 101.

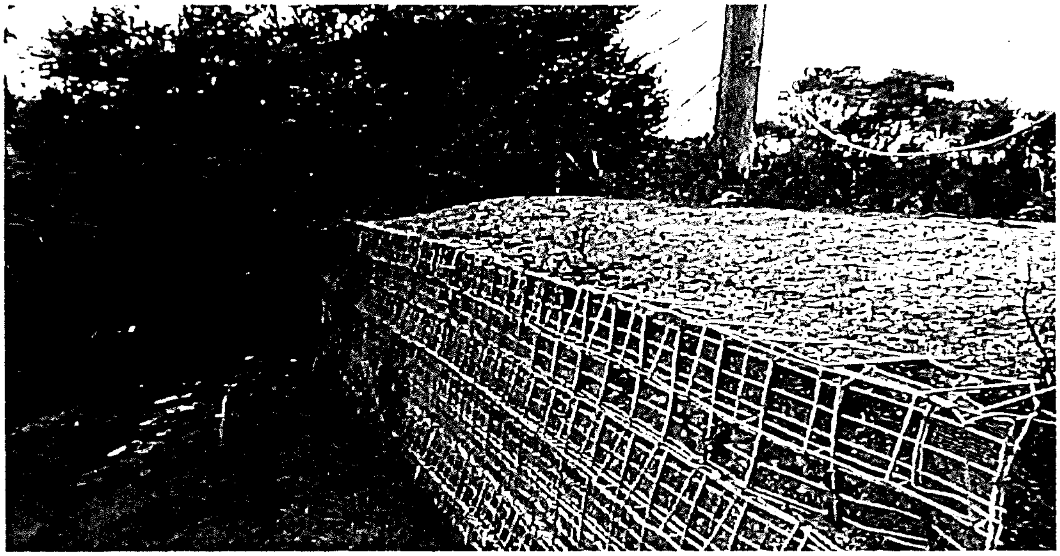
Appendix A includes the project site plans, typical cross sections and profiles of the earthwork that will be necessary to complete the project.

LEVEE IMPROVEMENTS

Downstream of Highway 101, the project reach is approximately 4,650 feet long, extending downstream from approximately station 78+00 to approximately station 31+50 where a pedestrian bridge exists. In this area, the project consists of adding earth material to the top of the existing levee, to bring the elevation back in compliance with the 1958 design plans. As there has been relatively uneven settlement of the levee over the years, the project will include adding different amounts of material to the levee, depending on location. In general, a minimum of 0.65 feet and a maximum of 2.64 feet of additional material will be added along the length of the levees on both sides of the creek. In areas where the existing levee surface is at the grade of the original levees, no construction is proposed. In some areas levee tops are higher than the 1958 elevations and are rutted. In these areas, the levee will be graded and aggregate will be added to create a smooth, uniform levee top.

The final levee configuration will have a 2:1 side slope, which will result in expansion of the levee footprint where there are no known sensitive wetlands or vegetation present. The levee footprint will be expanded approximately 2.5 feet beyond its existing configuration to obtain properly compacted final slopes (See figures in Appendix A).

Reinforced earth encased in Hilfiker wall structures will be used along the Santa Clara County side of the creek instead of earthen slopes to add the required height to the levee tops without requiring expansion of the levee toe. Hilfiker walls are a patented construction method that was used on the levee originally. A specially designed wire cage structure holds in the earthen material. This technique is planned along the entire the Santa Clara County side of the creek. On the East Palo Alto side, the same technique will be used to avoid pickleweed as is necessary. A typical cross-section and detail of the planned reinforced earth system is included in Appendix A. As pictured in the photos below of a higher Hilfiker wall, the proposed reinforced earth system will have an outer vertical edge of wire caging. This can be visually screened with existing or introduced vegetation.



The total work area along both levees is estimated at 4.5 acres. Approximately 7,200 cubic yards of material will be imported to the site to raise the levees. It is estimated that a total of 3,850 linear feet of levee, on both sides, will be restored with earthen fill and 4,750 linear feet will be restored with reinforced earth. Table 1 summarizes the distribution on both sides of the creek. Any excavated material will be used onsite or hauled away and disposed of appropriately.

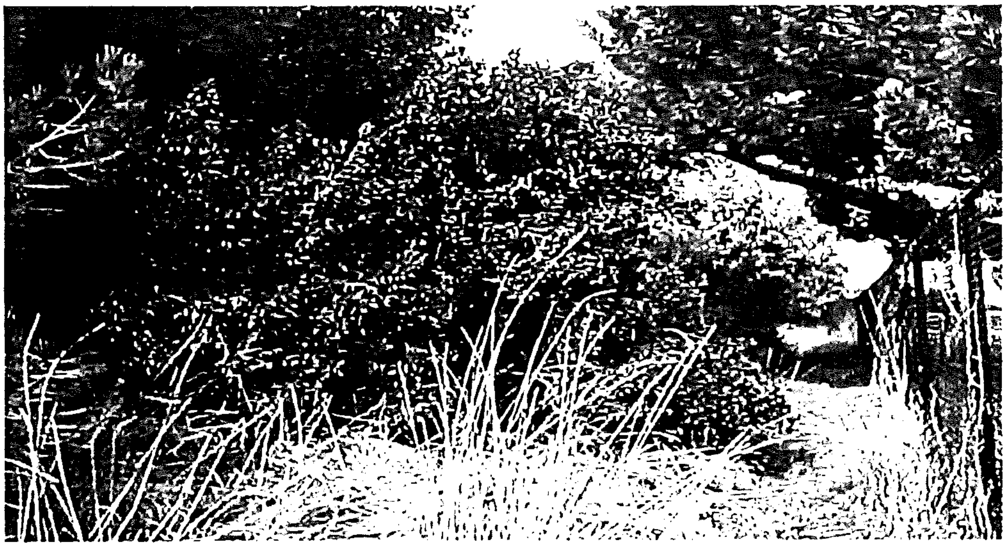


Figure 2 This is an example of where the reinforced earth system would be used to add levee height. The left side of the photo shows mature vegetation that has grown on the outboard side of the levee. The right side of the photo shows the golf course fence, which is within several feet of the levee toe. Traditional levee-raising techniques would require removing all of the vegetation, and working right up to the fence line. The reinforced earth system will avoid all construction work on the outboard (as well as inboard) side of the levee.

FLOODWALL IMPROVEMENTS

City of East Palo Alto

The project area is from approximately station 80 + 00 to 80 + 75, and from approximately station 90 + 20 to 91 + 30. No work will occur from stations 80 + 75 to 90 + 20. As mentioned previously, there is only one property owner along this reach of creek.

From station 90 + 20 to station 90 + 70 a new floodwall will be constructed to match the existing wall upstream. The existing weir and sacked concrete will be demolished, but only on the outboard side of the creek. No sacked concrete will be demolished on the inboard side of the creek. From station 90 + 70 to 91 + 30 the existing floodwall will be raised approximately 1.1 feet in height using formed in place concrete. Rebar for the floodwall will be doweled into the existing wall using epoxy grout. In addition, some demolition of existing cap on the existing floodwall will occur from station 90 + 70 to 91 + 30.

City of Palo Alto

The project area is from approximately station 80+30 to station 94+00. From approximately station 80+30 to station 91+00, the improvements will demolish and replace this portion of the existing wall with a formed concrete wall that will be approximately 12" in width and 2.3 to 5.2 feet in height. From approximately station 91+00 to approximately 94+00 (300 feet), the existing floodwall will have one row of sacked concrete added, resulting in a height increase of 6 inches (See Appendix A for floodwall cross-sections)

2.2.3 Description of Construction Activities

Construction for all both components (Levee Restoration and flood wall) activities is scheduled for summer 2002, and will occur between June 15th to October 15th,, to avoid impacting steelhead migration. Equipment to be used includes dump trucks, loaders, graders, and compactors. Water trucks will be used to moisten the material to be compacted and to control dust.

LEVEE RESTORATION

The levee construction will occur on top of the levee and may occur on either side of the levee sides, depending on the conditions of the vegetation at the toe of the levee (see Appendix A for typical cross-sections). Levee Restoration consists of adding either compacted earth (Levee Widening Method) or reinforced earth (Hilfiker Wall Method), and will not affect the levee foundations. The existing levee will remain and the restoration will not require removal or rebuilding of any portion of it. Large gradealls and dump trucks will be used to restore the levee and paving equipment will be used to restore the bike path. There will be no work or wetland fill within the existing creek channel area. The reinforced earth, where used, will be placed at both the inboard and outboard edge of the levee top, and will be approximately 0.65 to 2.64 feet in height. To install the reinforced earth components, excavation for a distance of 2 feet is required.

TABLE 1
LEVEE CONSTRUCTION METHODS

County Locations	**Method & Station Locations**	
	Reinforced Earth (Hilfiker Wall Method)	**Compacted Earth (Levee Widening Method)**
Santa Clara County	Station 32+55 (pedestrian bridge) to 57+00	Station 70+00 to 74+65

	Station 58+00 to 70+00	
San Mateo County	Station 43+50 to 44+50 Station 50+50 to 55+00	Station 32+00 to 43+00 Station 45+00 to 50+00 Station 55+50 to 71+00 Station 73+00 to 74+00
Total Distances	Santa Clara County: 3,645 feet San Mateo County 550 feet	Santa Clara County 465 feet San Mateo County: 3,315 feet
SOURCE: SCVWD		

Where the Hilfiker Method system will not be used, placing compacted earth on top of the existing levees requires that the top and construction side of the levee be cleared of all vegetation and any paved surface. The exposed levee and construction surfaces will be mechanically cleared of vegetation and then roughened to accept ("key into") the new material. Material will be placed on top of the levee and along the sides in thin lifts and compacted in place before placing the next lift of material. To achieve proper compaction, the levee will be overbuilt, extending up to 2.5 feet beyond the final footprint of the levee.

Upon completion of the restoration, a road surface consisting of approximately four inches of gravel material will be replaced on the levee top. In areas where a paved bike trail exists, the levee top will be repaved by the City of Palo Alto under their encroachment permit agreement with the SCVWD.

A work staging/storage area for materials and equipment will be sited on each side of the creek for the Levee Restoration work. On the City of Palo Alto side, the staging area will be between the levee and an existing Athletic Center, in the unpaved overflow parking area at the end of Geng Road. This staging area is located between stations 58+00 and 61+50 is approximately 0.3 acre, and will be used for both the Levee Restoration and the Floodwall Demolition and Reconstruction.

On the City of East Palo Alto side of the creek, the staging area will be located in an unpaved area between the end of O'Conner Street and the existing levee. This staging area is located between stations 32+ 50 and 35+ 00 is approximately 0.25 acre, and will be used for the Levee Restoration. A 150- square foot floodwall staging area will be located adjacent to the Floodwall Demolition and Reconstruction project site on the City of East Palo Alto side of the creek.

FLOODWALL DEMOLITION AND RECONSTRUCTION

Most floodwall work is proposed to occur from the creek channel bottom because there is limited access at the tops of the creek banks. Because this section of the creek is tidal, 24-hour dewatering will begin June 15th and continue until Oct 15th. Dewatering will be done through the installation of cofferdams and pumps and the implementation of SCVWD BMPs.

Equipment to be used includes bobcats and other similar small equipment at top of bank. Large Gradealls, concrete trucks and dump trucks will be used from channel bottom. The use of heavy equipment in the channel will start on July 1st, after the channel has adequately dried for construction vehicle access. Additionally, 2 gasoline-powered water pumps will run 24 hours per day to keep the water table from rising into the work area, one upstream of the project site and one downstream of the project site.

For the Floodwall Demolition and Reconstruction work on the East Palo Alto side of the creek, a staging area will be located at the project site just off West Bayshore Road. Vehicles cannot be stored in the bottom of the creek, but may be parked on the construction ramp.

On the Palo Alto side of the creek, there are two distinct construction options for the floodwall demolition and reconstruction. The preferred option is to work from the bottom of the channel because it would be less intrusive to the 15 property owners that are adjacent to the construction area. This option would remove less of the existing riparian canopy at the top of the bank. It would also result in a shorter construction period, thus saving time and money. The other option is to work completely from the top of the bank.

Both options will include the following steps. (1)Existing backyard fences will be removed; (2) a temporary construction fence will be erected to provide needed working space and shield residents from dust and noise; (3) vegetation in the working area will be removed, but heritage trees will be preserved and protected; (4) existing floodwall will be demolished; (5) a new floodwall will be built; and (6) new backyard fences will be constructed and the construction fence will be removed. Residents will be compensated for vegetation removed from their property, so that they can replace back yard landscaping according to their own wishes.

If the work is conducted from the channel bottom, a 6-foot wide work space at the top of the bank is needed. Except for Heritage trees, vegetation in the work area will be removed. Four of the existing backyard fences are set back far enough so that adequate workspace is available. Ten backyard fences will have to be removed completely and one partially to provide adequate workspace. At the property adjacent to West Bayshore Road, a larger temporary easement will be used as the point of channel access where a temporary earthen ramp will be constructed into the channel. Since the area is tidally influenced and the elevation of the channel bottom is so low (near 0 feet above mean sea level), coffer dams will have to be constructed above and below the project reach and pumps installed to insure that the channel reach stays dry during construction. Normally, this reach would be dry during this part of the year except for tidal flow. Gravels will be temporarily added to the channel bottom to provide a firm footing for the construction vehicles. After the new floodwall is constructed, the channel will be returned to its pre-construction condition and the temporary ramp into the creek channel removed.

If the work is conducted from the top of the bank, a 15-foot wide workspace will be needed. All 15 backyard fences will be completely removed and a temporary construction fence (consisting of 6 foot tall chain link fencing with screened slats) will be built along the project reach. This fencing will remain until construction is completed and backyard fences are replaced. Although mature trees will be protected and worked around, most vegetation in the 15-foot workspace will be removed. At the property adjacent to West Bayshore Road, a larger temporary easement will be used as in the channel bottom option to provide an area where the construction equipment can be maneuvered onsite. All equipment and construction personal will access the site from West Bayshore Road. Since a narrower work corridor is available on the top of the bank, smaller, less efficient equipment will be used.

The private properties on both sides of the creek in the area of the floodwall site extend to the center of the creek. On the Palo Alto side, 15 homeowners own portions of this stretch. SCVWD holds an easement on these properties along the creek bank. These homeowners have erected tall fences, ranging from 6 to 9 feet tall, between their yards and San Francisquito creek. These fences will be removed and replaced in-kind after construction. Temporary screened fences

2.3 MITIGATION MEASURES INCORPORATED INTO THE PROJECT

The following Mitigation Measures Incorporated into the Project will help to reduce or avoid significant adverse environmental impacts. Many of these measures are Best Management Practices (BMPs) derived primarily from SCVWD's Stream Maintenance Program

(SMP) EIR. BMPs are methods, measures, or practices that avoid, reduce or minimize a project's effects on various resources. BMPs include, but are not limited to, structural and nonstructural controls and operation and maintenance procedures. These BMPs will be included in the project's Mitigation, Monitoring and Reporting Program.

1. All work will be performed between June 15 to October 15.
2. The contractor will implement the following maintenance practices that minimize disturbances to neighborhoods surrounding work sites:
   - Internal combustion engines shall be equipped with adequate mufflers.
   - Excessive idling of vehicles will be prohibited.
   - Levee traffic shall be limited to a speed of 15 miles per hour.

   - Dry sediment shall be wetted down or covered as needed to control dust during transport.
3. The contractor shall implement measures to minimize soil from being tracked onto streets near work sites. Methods used to prevent mud from being tracked out of work sites onto roadways include installing a layer of geotextile mat, followed by a 4-inch thick layer of 1-3- inch diameter gravel on unsurfaced access roads.
4. If possible, all work will be conducted during normal working hours, Mondays through Fridays. In and adjacent to residential areas, no construction will occur between the hours of 6:00 PM and 8:00 AM, unless otherwise permitted or restricted by local ordinances.
5. To protect pedestrians, bicyclists and other recreational users, the Contractor shall post signs warning of the construction and truck traffic several hundred feet beyond the limits of work and shall post signs at least one month in advance of construction to alert trail users to temporary path closures. Orange safety fencing or chain link fencing shall be installed around the construction area as needed. Temporary detours may be created, where available, to minimize conflicts with recreational users on the levee trail on the Palo Alto side of the creek.
6. Pumps and generators will be maintained and operated in a manner that minimizes impacts to water quality and aquatic species.
7. Pumps and generators will be maintained according to manufacturers' specifications to regulate flows to prevent dryback or washout conditions.
8. Pumps will be operated and monitored to prevent low water conditions, which could pump muddy bottom water, or high water conditions, which creates ponding.
9. Pump intakes will be screened to prevent uptake of fish and other vertebrates.
10. If soil is to be stockpiled, no run-off will be allowed to flow back to creek.
11. During construction, the amount of soil exposed at one time will be minimized. The project will be scheduled sot that only portions of the site are disturbed at one time. Grading will proceed as expeditiously as possible. Disturbed areas will be stabilized as soon as possible before grading the next portion.
12. Upon completion of grading in any given area, the soil surface will be protected. One or combination of the following measures will supply immediate protection:
    - A minimum three inch application of blown straw or mulch product,
    - installation of an erosion control blanket or hydroseeding/hydromulching with and erosion control seed mix composed of species that are consistent and compatible with surrounding vegetation.
    - Mulch can be ground-up woody products and/or leaves from either native material or from soil suppliers. No non-native material that has alleopathic compounds (Eucalyptus spp.) will be used.

    Deleterious material such as glass, plastics, weed seeds, paints, petroleum products, or chemical residues that may be harmful to plant or animal life contained in straw or mulch material will not exceed 0.1 percent of the straw or mulch volume.

13. Equipment storage and maintenance sites will be located outside of the channel area, and trees or other vegetated areas will not park equipment in order to avoid soil compaction. Staging and storage areas will be properly fenced for security. Secondary containment will be provided for chemical storage to ensure adequate containment in the event of spills or leaks.
14. To reduce sediment tracking offsite, construction entrance(s) will be stabilized with an aggregate or gravel pad. Staging areas, parking areas and other non-paved areas will be similarly protected with gravel, aggregate or other surface protection measures, where appropriate, to prevent offsite tracking of sediment.
15. Bay Area Air Quality Management District (BAAQMD) Basic Control Measures for reducing air quality impacts will be implemented at all staging areas and worksites. Current measures stipulated by the BAAQMD CEQA Guidelines include the following:
    - Active maintenance areas will be watered at least twice per day unless soils are already sufficiently moist to avoid dust.
    - Trucks hauling sediments and other loose material will be covered or shall maintain at least two feet of freeboard.
    - Tailgates of trucks will be sealed.
    - Trucks will be brushed down before leaving the maintenance site.
    - Unpaved access roads and staging areas that are being used for the maintenance activity will be watered three times daily, or non-toxic soil stabilizers will be applied to control dust generation.
16. Paved maintenance site access roads will be swept when visible soil material is carried into the roadway.
17. All construction equipment will be equipped with manufacturer's standard noise control devices; internal combustion engines will be equipped with adequate mufflers. Excessive idling of vehicles will be prohibited.

Section 3. Environmental Checklist Form And Responses

3.1 BACKGROUND

1. Project Title:
San Francisquito Creek Levee Restoration and Floodwall Reconstruction Project

2. Lead Agency Name and Address:

San Mateo County Flood Control District (District)
Department of Public Works
555 County Center, 5th Floor
Redwood City, California 94063-1665

3. Contact Person and Phone Number:
Walt Callahan, Flood Control Utilities Manager (650) 599-1417

4. Project Location: Portion of cities of Palo Alto in Santa Clara County and East Palo Alto in San Mateo County See Figures 1 -2 in subsection 2.1

5. Project Sponsor's Name and Address:

San Mateo County Flood Control District
Department of Public Works
555 County Center, 5th Floor
Redwood City, California 94063-1665

6. General Plan Designation: Not applicable

7. Zoning: Not applicable

8. Description of the Project: See Section 1 and 2 of the Initial Study

9. Surrounding Land Uses and Setting: Various. See Section 2

10. Other public agencies whose approval is required:
- U.S. Army Corps of Engineers, Nationwide permit to operate construction equipment in creeks
- California Department of Fish and Game, Section 1601, Streambed Alteration Permit
- SF Bay Area Regional Water Quality Control Board Section 401 certification or Waiver of Waste Discharge

3.2 ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

- ☐ **Aesthetics**
- ☐ **Agriculture Resources**
- ☐ **Air Quality**
- ☐ **Biological Resources**
- ☐ **Cultural Resources**
- ☐ **Geology /Soils**
- ☐ **Hazards & Hazardous Materials**
- ☐ **Hydrology / Water Quality**
- ☐ **Land Use / Planning**
- ☐ **Mineral Resources**
- ☐ **Noise**
- ☐ **Population / Housing**
- ☐ **Public Services**
- ☐ **Recreation**
- ☐ **Transportation/Traffic**
- ☐ **Utilities / Service Systems**
- ☐ **Mandatory Findings of Significance**

	Potentially Significant Impact	**Less Than Significant with Mitigation Incorporation**	**Less Than Significant Impact**	**No Impact**
I. AESTHETICS -- Would the project:				
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☐	☒
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☒	☐
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☒	☐	☐

Discussion:

Would the project:

a-b) Have a substantial adverse effect on a scenic vista? b) Substantially damage scenic resources, including but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway?

No Impact. The project site is not located within or adjacent to areas with scenic resources or historical buildings as designated in local General Plans. The site is not located within a designated state scenic highway corridor.

c) Substantially degrade the existing visual character or quality of the site and its surroundings?

Less than Significant Impact.

The Levee Restoration project will not result in a discernible visual change from either the top of the levee or from adjacent areas The Floodwall Demolition and Reconstruction project will not substantially degrade the quality of the site and its surroundings nor will it have a significant effect on the scenic vista of San Francisquito Creek. The final formed concrete wall structure may actually be an aesthetic improvement over the existing sacked concrete wall.

LEVEE RESTORATION

The Levee Restoration project site is intermittently visible from the Palo Alto Golf Course greens and potentially from some residential properties located on the west side of the creek within the city of East Palo Alto. However, the majority of the existing residences have six-foot-high walls or fences along their back yards that block views of the levee. Both sides of the levees are visible from the top of the levee pathway on the Palo Alto side that is used by bicyclists and pedestrians.

The proposed project will result in raising the levee elevations by 0.65 to a maximum of 2.64 feet in height on both sides of the creek. Given this low height increase, the project will not result in a discernible visual change from either the top of the levee or from adjacent areas. The earthen levee will not look substantially different than what currently exists, and thus, will not substantially degrade or change the existing visual character of the site or surrounding area. Further, the height of the levee is being raised to the original height/elevation as designed and constructed in 1958.

The reinforced earth system is proposed to prevent removal of mature vegetation and impacts to jurisdictional wetlands (see Biology subsection in Chapter 3, below for further discussion on wetlands). A similar structure was installed at the downstream end of the project site adjacent to the existing pedestrian bridge.

The proposed reinforced earth system may be intermittently visible to some golfers at the Palo Alto Golf Course, but given the distance of the viewer and the low level of the added height, the structure would appear earthen and blend in with the surrounding area. Additionally, this structure will be screened in many locations due to existing vegetation.

FLOODWALL DEMOLITION AND RECONSTRUCTION

The floodwall demolition and construction site will be visible to the residents of the new Woodland Creek complex on the San Mateo County side of the creek. The building has recently been completed, and full occupation may have occurred at the time that this document is completed. Heavy machinery is proposed to be used in San Francisquito Creek and may temporarily degrade the views and existing character of the site for the residents adjacent to the creek. However, because the construction period would be temporary, and because the creekbed is approximately 20 feet below the grade of the surrounding area, this impact is considered to be less than significant.

The private properties on both sides of the creek in the area of the floodwall site extend to the center of the creek. On the Palo Alto side, 15 homeowners own portions of this stretch. SCVWD holds an easement on these properties along the creek bank. These homeowners have erected tall fences, ranging from 6 to 9 feet tall, between their yards and San Francisquito creek. These fences will be removed and replaced in-kind after construction. Temporary screened fences (consisting of 6 foot tall chain link fencing with screened slats) will be installed during construction. The project will be more visible from the residents of the Woodland Creek complex (East Palo Alto side). However, the construction phase of the project will be temporary and the final floodwall will be similar in appearance to the existing floodwall. Since the new floodwall will be constructed of formed concrete, it will improve in appearance in comparison to the existing floodwall.

The project site will be briefly visible to pedestrians and drivers traveling along the frontage road, West Bayshore. However, due to the distance of the project from the road and the short distance along the road from which the project will be visible, there is not expected to be a significant impact on frontage road traffic. The stretch of creek in the vicinity of the floodwall is on private property and is not open to public access, so there will be no impact on the public using the area for recreational purposes.

d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?

Less Than Significant with Mitigation Incorporation. No construction will occur at night at either the levee or the floodwall sites. Therefore no nighttime views will be affected during the construction phase. However, the new construction staging areas will have security lighting. Mitigation measures contained in this section will reduce impacts from light and glare resulting from this new lighting to less than significant levels.

There will not be any permanent changes to day or nighttime views as a result of the proposed project. No lighting currently exists on the levee trails and no lighting is proposed as part of the project. There will not be any new permanent lighting in the area of the floodwall as part of the project. The levee additions will be made of earthen fill and reinforced earth and the proposed floodwall construction materials are formed and sacked concrete. These materials will not result in additional glare.

Mitigation measure AES-1: Temporary security lighting at the construction staging areas shall have motion sensors so that the lights do not stay on all night. All new light fixtures shall have glare guards to direct the light beams downward and to shield surrounding areas from additional light or glare.

Implementation:	District, through SCVWD
Timing:	Construction Phase
Fiscal responsibility:	JPA Member Agencies
Monitoring:	San Mateo County Department of Public Works

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
II. AGRICULTURE RESOURCES -- In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?	☐	☐	☐	☒

Discussion:

Would the project:

a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?

No Impact. The project site is located on and adjacent to an existing flood control channel. Project construction will occur on the levee adjacent to San Francisquito Creek. The site is bordered by a mix of urban uses on the east, south and west, and open space wetland uses on the north. The site is not located on or adjacent to agricultural lands, and will not result in conversion of agricultural lands.

b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?

No Impact. As indicated above, the site is not located on or adjacent to agricultural lands. According to the city of Palo Alto General Plan (Map L-9), there are no known Williamson Act contracts in the city of Palo Alto. The site is located adjacent to residential development in the city of East Palo Alto.

c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use?

No Impact. As indicated above, the site is not located on or adjacent to agricultural lands, and the project will not have any affect upon existing agricultural operations, as none exist in the vicinity.

	Potentially Significant Impact	**Less Than Significant with Mitigation Incorporation**	**Less Than Significant Impact**	**No Impact**
III. AIR QUALITY -- Where available, the significance criteria established by the applicable air quality management or air pollution control District may be relied upon to make the following determinations. Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☐	☒
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☒	☐	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☐	☒	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☒	☐
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☒

Discussion:

Would the project:

a) Conflict with or obstruct implementation of the applicable air quality plan?

No Impact. The project is a temporary construction project, and will not result in new population or growth or inconsistencies with the existing air quality management plan for the region. The project is a short duration maintenance activity to provide flood control to surrounding properties and infrastructure and will not conflict with nor obstruct implementation of air quality plans; thus, no impact will occur.

b) Violate any air quality standard or contribute to an existing or projected air quality violation?

Less Than Significant Impact with Mitigation Incorporation. The project site is all located in the Bay Area Air Quality Management District (BAAQMD). Currently, the Bay Area, which includes Santa Clara and San Mateo Counties, is in attainment for all national air quality standards, but is in non-attainment for two pollutants under state standards--ozone (one-hour standard) and fine particulate matter (PM10-both annual mean and 24-hour standards).

Project construction will result in disturbance and/or construction on approximately 4.5 acres over 3 to 5-month period. According to BAAQMD CEQA Guidelines, projects that implement all of the control measures for construction activities as identified in the Guidelines (Table 2 of BAAQMD CEQA Guidelines, April 1996) will not result in a significant impact (Bay Area Air Quality Management District, April 1996). The project proposes implementation of BMPs to adhere to BAAQMD requirements. These BMPs are listed in Section 2.3 of this document.

c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?

d) Expose sensitive receptors to substantial pollutant concentrations?

Less Than Significant Impact. The project will not result in an increase in population or result in a new source of stationary or ongoing permanent mobile emissions. Given the short-duration, the nature of construction activities and implementation of BMPs, consistent with BAAQMD guidelines, the project will not significantly contribute to existing or projected air quality violations, and thus, will not result in a cumulatively considerable net increase for ozone or PM_{10}, or expose sensitive receptors to substantial pollutant concentrations.

e) Create objectionable odors affecting a substantial number of people?

No Impact. The importation of engineered fill and reinforced earth materials will not result in generation of odors to adjacent recreational users or residents.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
IV. BIOLOGICAL RESOURCES -- Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☒	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?	☐	☒	☐	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☒	☐	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☒	☐	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☒	☐
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒

Discussion:

Biotic reports were written by Kathleen Lyons of the Biotic Resources Group (2001) and Thomas Ryan and Lisa Falco of SCVWD (1998) for both the levee restoration and floodwall portions of the project. In November 2001, Thomas Reid Associates biologists surveyed the site and searched the California Natural Diversity Database (CNDDB). The findings of these surveys and recommended mitigation measures are incorporated below.

Would the project:

a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?

Less Than Significant Impact with Mitigation Incorporation.

Overview

No special status plant or animal species were found in the Levee Restoration project area (between Hwy 101 and San Francisco Bay) during reconnaissance-level surveys by Santa Clara Valley Water District biologists (Ryan and Falco 1998). No special status species were found in the Floodwall Demolition and Reconstruction project area (upstream of Hwy 101). TRA biologists resurveyed the floodwall and levee areas in November 2001. During this survey, a special status plant, marsh gum plant (*Grindelia stricta angustifolia*), was found growing in the pickleweed habitat on the inside of the levees. This plant is listed by the California Native Plant Society on the watch list (CNPS 4), which means that the marsh gum plant is a plant of limited distribution. San Francisquito Creek is critical habitat for the federally threatened Central California Coast Steelhead Evolutionary Significant Unit (ESU).

A search of the California Natural Diversity Database (CNDDB) by TRA (2001) revealed the occurrences for several special status species within 5 miles of the site. Ten special status animals, six special status plants, and one special status plant community have been recorded within this 5-mile radius and are discussed below. These ten special status animal species known to exist in the area include steelhead trout, salt marsh harvest mouse, and California clapper rail. Also of concern are burrowing owl, California black rail, salt marsh wandering shrew, California least tern, yellow warbler, salt marsh common yellowthroat, and western snowy plover. Sensitive plant species that have been found in the area include alkali milk vetch, Congdon's tarplant, marsh gum plant, Point Reyes bird's-beak, California seablite, and western leatherwood. These species and potential impacts to them are summarized below, and mitigation measures are identified for each species, as applicable. For a complete listing of all plants and animals known or expected to exist within the project area, please see Appendix C.

Potential impacts that are listed below are expected to primarily occur during the construction phase of the proposed project. No significant biological impacts are expected to occur once the construction process is completed.

LEVEE RESTORATION

The construction phase of the proposed Levee Restoration project will be conducted entirely outside the channel bottom and will not affect habitat within the channel. The project includes implementation of BMPs to install silt fencing and/or other barriers to prevent sediment and debris from entering the stream channel and affecting water quality, as well as BMPs to prevent construction materials, fluids, or runoff from entering the stream channel (see BMPs in subsection 2.3). The pickleweed habitat areas adjacent to the project area will be fenced with orange plastic fencing to ensure construction vehicles or personnel do not disturb the habitat.

The reinforced earth method of the Levee Restoration project will avoid impacts to pickleweed and wetland areas and allow mature vegetation and trees to stay in place. The compacted earth method will involve clearing all vegetation off of the top and outboard slope of the levee only in areas where sensitive plants or plant communities are absent. Since the levees were originally constructed using fill, it is highly unlikely that a native sensitive plant or plant community will have established on the top or outboard side of the levee.

However, since the outboard toe of the levee could support sensitive species or communities in areas where the compacted earth method will be used, the following mitigation measure will be applied throughout the Levee Restoration project area, as applicable:

Mitigation measure BIO-1: Within 30 days of construction start date, a qualified biologist (familiar with the sensitive species that could be present at the San Francisquito Creek project sites) shall survey for sensitive animals, plants and communities in areas where the compacted earth method of levee raising shall be used.

For the annual plant species listed in this section, a qualified botanist familiar with the sensitive species shall survey for these sensitive plants during their flowering season.

In the event that a sensitive animal, plant or community is found, the alternative construction method of reinforced earth shall be used. All sensitive animals, plants and communities and their buffer zones shall be surrounded by orange safety fencing. The buffer zone width may vary depending on the location, type of plant/community and type of construction work in the area, and shall be determined by the biologist.

Implementation:	District, through SCVWD
Timing:	No more than 30 days prior to construction except for the annual plants, flowering times are listed in this section.
Fiscal responsibility:	JPA Member Agencies
Monitoring:	San Mateo County Department of Public Works

Discussion of Special status Species that may exist within the Levee Restoration Project site area

1. Steelhead Trout (*Oncorrhynchus mykiss*)

As stated above, San Francisquito Creek is critical habitat for the federally threatened Central California Coast Steelhead Evolutionary Significant Unit (ESU). The Levee Restoration portion of the project will not result in direct removal of critical habitat or riparian vegetation. The project will not occur within the creekbed and thus will not have an adverse effect on fish species.

While San Francisquito Creek is a steelhead migration corridor, impacts to this species as a result of the Floodwall Demolition and Reconstruction portion of the project are not expected, because the construction times are from June 15 to October 15. This construction window has been chosen because it is outside of the dates that the steelhead adults and out-migrating smolts use the creek for migration, which are November through May. Due to the location of the project at the downstream end of the watershed near San Francisco Bay, the project is unlikely to impact any over-summering steelhead parr (young fish), which utilize higher gradient portions of San Francisquito creek and its upper tributaries.

2. Salt Marsh Harvest Mouse (*Reithrodontomys raviventris*)

The Federally and State Endangered salt marsh harvest mouse is most abundant in dense pickleweed salt marshes and inhabits the salt marshes fringing San Francisco Bay. Habitat for the salt marsh harvest mouse is present on both sides of the San Francisquito Creek (H.T. Harvey, 2001). Application of mitigation measure BIO-1 will ensure that any mice present in the construction areas of the Levee Restoration project area will be protected from these activities.

The salt marsh harvest mouse rarely leaves pickleweed habitat unless forced to do so by high water or other localized disturbances. High water events could occur during the construction period. Thus, the salt marsh harvest mouse could be impacted by direct loss of habitat and necessary refugia during these high water events. Flows greater than approximately 2,000 cfs would be high enough to inundate half of the pickleweed habitat. According to SCVWD biologist Doug Padley, these high flows occur when the water level is at 7.5 ft. elevation (NGVD29 - based on 1999 surveyed cross-sections and the measured height of pickleweed in the project vicinity). Such flows occur on average once every two years. This water level may be reached during very high tides or during large storm events when high flows are in the channel.

In order to prevent disturbance to salt marsh harvest mice during high water events, the following mitigation measure shall be implemented:

Mitigation Measure BIO-2: In order not to impede upland habitat usage, construction activities shall be suspended in areas adjacent to pickleweed habitat when water levels in the channel inundate 50% of the pickleweed habitat (Padley, SCVWD). The level of 50% inundation shall be established in the field by a qualified biologist in collaboration with SCVWD and shall be marked clearly in the field so that recognition is obvious. Construction workers will be briefed by a qualified biologist on the presence of the salt marsh harvest mouse and how to recognize 50% pickleweed inundation during high tide events.

Implementation:	District, through SCVWD
Timing:	The inundation levels shall be marked within 30 days prior to start of work, and then pre-construction briefings with the contractor shall be performed at start of work.
Fiscal responsibility:	JPA Member Agencies
Monitoring:	San Mateo County Department of Public Works

3. California Clapper Rail (*Rallus longirostris obsoletus*)

The clapper rail is a Federal and State Endangered species. The project will not result in removal of salt marsh habitat that occurs within the creek channel. The proposed raising of the levees in the area of the salt marsh habitat will be conducted from the levee top and will result in some minor pruning and vegetation removal within 3 feet of each side of the levee top. Vegetation in these areas include mostly non-native vegetation intermixed with scrub vegetation (predominantly coyote bush) and one short segment of riparian willow vegetation. Project construction will not encroach into the channel nor remove wetland, marsh or upland habitat.

However, the proposed project will occur during the clapper rail nesting season California clapper rails begin nest building in late March. Second clutches may be initiated in June and July, with eggs hatching in July. Clapper rails are known to breed downstream in the Don Edwards San Francisco Bay National Wildlife Refuge and have been found downstream of the levee restoration project site on the San Mateo side of the creek. SCVWD staff biologists have completed nesting surveys for this species along the project channel. The results of this survey will be finalized after production of this document.

Construction activities that commence during the nesting season could interfere with nesting due to noise and other disturbances. Thus, the following mitigation measure shall be implemented:

Mitigation Measure BIO-3: The Levee Restoration project site shall be checked by biologists for nesting birds in conformance with the USFWS formal Clapper Rail protocol no more than 30 days prior to starting levee restoration activities. In areas where nesting birds are found or are likely to occur, the construction period will be modified so that work is not done during active nesting in the area and/or appropriate buffers have been established in consultation with a qualified biologist and USFWS.

Implementation:	District
Timing:	No more than 30 days prior to start of work.
Fiscal responsibility:	JPA Member Agencies
Monitoring:	San Mateo County Department of Public Works

4. Burrowing Owl (*Athene cunicularia*)

The burrowing owl is a Federal and State Species of Special Concern (SSC). Although burrowing owls are known to occur in levees (including at Palo Alto Municipal Airport, CNDDB 2001), they are not known to occur at the San Francisquito Creek. However, the levees along San Francisquito Creek may provide suitable owl habitat (Scott Wilson, CDFG, pers. comm.). Thus, burrowing owls, if present, could be impacted by the proposed construction project. In order to avoid impacts, the following mitigation measure will be implemented.

Mitigation Measure BIO-4: To avoid potential impacts to burrowing owls from construction activities, the following measures shall apply:

1. Preconstruction surveys shall be conducted by a qualified biologist prior to any soil-altering or other pre-construction activities. The preconstruction surveys shall be conducted per CDFG guidelines. Any and all surveys shall be performed no more than 30 days prior to the start of soil disturbance in any given project segment. If no burrowing owls are found, then no further mitigation would be needed. If burrowing owls are found, then further mitigation shall be implemented, as follows:

If breeding owls are located on or immediately adjacent to proposed construction areas, a construction-free buffer zone must be established around the active burrow(s) as determined by the biologist in consultation with CDFG. No activities, including grading or evictions of owls, should proceed that may disturb breeding owls. Construction in those buffer areas should take place outside of the breeding season (February 1 through August 31, with peak period April and May) or after the biologist has determined that all breeding activity has concluded for the season and any young have fledged. If burrows occupied by owls are found and the burrows could be physically impacted by proposed improvements, then mitigation measure (2) shall also be implemented.

2. The project should be redesigned to avoid direct impacts to occupied burrows. Avoidance is the preferred mitigation approach. If the project cannot be redesigned to avoid occupied burrows, then the owls could be evicted from the site. Owls shall only be evicted outside of the February 1 through August 31 breeding season. Evictions shall only be implemented by a qualified biologist in consultation with CDFG. The proposed project would permanently impact at most only a very small amount of potential burrowing owl habitat and does not propose management measures that would preclude colonization by ground squirrels or burrowing owls. These avoidance measures would thus be adequate to reduce the impact to a less-than-significant level. Additional mitigation may be required by CDFG, however, as a condition for permitting eviction.

Implementation:	District
Timing:	No more than 30 days prior to start of work.
Fiscal responsibility:	JPA Member Agencies
Monitoring:	San Mateo District

5. California Black Rail (*Laterallus jamaicensis coturniculus*)

The California black rail is a Federal Threatened and State Species of Concern. This species has been recorded within 5 miles of the site and has the potential to occur in the pickleweed salt marsh and tidal slough habitat on the site. In a 1986-1988 survey, the single South Bay breeding location was in the Don Edwards San Francisco Bay National Wildlife Refuge's large Dumbarton Marsh (Evens 2001). This area is across the Bay from the levee restoration site. Black rails do occur more regularly in the South Bay during the winter months than in the summer months (J. Albertson, pers. comm). Six black rails were sighted at the Palo Alto Baylands during winter flood tides on January 9, 2001 (San Francisco Bay Bird Observatory [SFBBO] 2001). These birds are assumed to have dispersed to the South Bay after being reared in the North (Evens 2001). Based on the habitat present on and adjacent to the Levee Restoration site, California black rail presence in the vicinity of the levee-raising project shall be assumed during the winter months.

However, the proposed project will not impact the black rail because they are likely to be present in the project area only during the winter months, and this project is proposed to occur during June 15-October 15.

6. Salt marsh wandering shrew (*Sorex vagrans halicoetes*)

This species is a federal special concern species (FSC) and a California species of special concern (CSC). The salt marsh wandering shrew is restricted to pickleweed salt marshes of San Francisco Bay and has been recorded within 5 miles of the site. Their center of activity is in the "medium high marsh," about 6 to 8 feet above sea level, and in lower marsh areas not regularly inundated (Goals 2000, from the Baylands Ecosystem Species and Community Profiles: Life histories and environmental requirements of key plants, fish and wildlife). Suitable sites are characterized by abundant driftwood and other debris scattered among pickleweed. The pickleweed is usually one to two feet in height (Goals 2000). Historic populations where current status is unknown are located at Ravenswood Slough, Ravenswood Point and Cooley Landing (WESCO 1986). Distribution of this species is difficult to document and has not been done thoroughly due to the high mortality associated with trapping (pers. comm. J. Albertson).

This species requires low, dense cover of pickleweed and has the potential to occur in the pickleweed salt marsh habitat present on the levee restoration site. If they are present, implementation of mitigation measures BIO-1 and BIO-2 will reduce impacts to less than significant levels.

7. California least tern (*Sternum antillarum browni*)

This species is listed as a state and federal endangered species (State Endangered and Federal Endangered. The California least tern is a summer migrant in California and requires lagoons and estuaries for feeding and open, sandy or gravelly shores for nesting. Nesting colonies for this species exist in the North and East Bay at Alameda, Pittsburgh, and Albany shorelines. Breeding season lasts from late March to as late as mid-August (Meredith Elliot, pers. comm.); nesting terns prefer sand or gravel substrates. No least terns have been recorded nesting in the south bay (ibid.). Roosting colonies have been observed on the Mountain View and Sunnyvale shorelines within three miles south of the project site (San Francisco Bay Bird Observatory [SFBBO] 2001).

California least terns are not using the Levee Restoration project area to breed. Due to recreational usage of the southern levee, and the proximity of the northern levee to a residential area, it is also highly unlikely that least terns are using the area to roost. Thus, this species will not be impacted by the proposed project.

8. Yellow warbler (*Dendroica petechia*)

This species is a California species of special concern and is usually found in riparian deciduous habitats in summer: cottonwoods, willows, alders, and other small trees and shrubs typical of low, open-canopy riparian woodland, and in montane shrubbery in open conifer forests. The yellow warbler breeds from mid-April into early August, with peak activity in June. Due to the lack of riparian deciduous habitat adjacent to the levee restoration site, this species is not likely to occur in the project area. Thus, this species will not be impacted by the proposed project.

9. Salt marsh common yellowthroat (*Geothlypis trichas sinuosa*)

This species is a California species of special concern. It is a resident and summer visitant in the San Francisco Bay area and inhabits emergent wetland. Due to the lack of emergent wetland vegetation (*Scirpus* spp.), this species is not likely to occur in the project area. Thus, this species will not be impacted by the proposed project.

10. Western snowy plover (*Charadrius alexandrinus*)

Salt ponds, their levees, and pond edges, which may mimic historic salt pan habitat in some essential way for the plover, provide almost all known snowy plover nesting habitat in San Francisco Bay today. Their nest is a simple scrape in the ground lined with items such as small pebbles, shell fragments, plant debris and mud debris. Foraging occurs on sandy beaches, salt evaporation ponds, or tidal flats.

Snowy plovers are disturbed by hikers, joggers, dogs, and avian predators (Goals 2000). Due to the abundance of recreationists, domestic animals and other animals associated with urban areas, snowy plovers are highly unlikely to nest in the vicinity of the proposed levee-raising site and will not be impacted by the proposed project. Further, there is a lack of habitat near the project site. Thus, this species will not be impacted by the proposed project.

Plants

1. Alkali milk vetch (*Astragalus tener tener*).

This annual species is listed as a CNPS 1B plant and is found in alkaline flats, vernal pools, playas, and valley and foothill grassland (adobe clay) (Corelli and Chandik 1995). The only CNDDB record of this plant within five miles of the project is from a 1905 observation near the historic town of Mayfield (an area which was later incorporated into Palo Alto) (2001). As of 1961, this plant was still known from saline areas along San Francisco Bay, San Francisco and Mayfield. It was recently rediscovered near historic Bay edge in Fremont, Alameda District (Goals 2000, from the Baylands Ecosystem Species and Community Profiles: Life histories and environmental requirements of key plants, fish and wildlife).

Alkali milk vetch is an annual herb that flowers from March to June. Mitigation measure BIO-1 will ensure that the soil compaction method will not be used at the base of the levee in areas where alkali milk vetch is growing, and Mitigation Measure BIO-7 (below) will protect it from impacts of siltation and erosion.

2. Congdon's tarplant (*Centromadia parryi congdonii*).

This perennial species is listed as a CNPS 1B plant. It is found in alkaline soils in valley and foothill grassland (Corelli and Chandik 1995) and has been found approximately 1.5 miles away from the site (TRA 2001 survey) in an upland, ruderal area. This species will not be impacted by the proposed project because Mitigation measure BIO-1 will ensure that the soil compaction method will not be used at the base of the levee in areas where Congdon's tarplant is growing, and Mitigation Measure BIO-7 (below) will protect it from impacts of siltation and erosion.

3. Marsh gum plant (*Grindelia stricta angustifolia*).

This limited-distribution perennial species is listed as a CNPS 4 plant. It is found in tidal areas and coastal saltwater marsh (Corelli and Chandik 1995). This species is common in the saltwater marsh areas on the property and in the surrounding marshlands. This species is typically limited to marshlands in its distribution and was not detected in the upland portion of the levees. This species will not be impacted by the proposed project because application of Mitigation Measure BIO-1 will ensure that the soil compaction method will not be used at the base of the levee in areas where marsh gum plant is growing, and Mitigation Measure BIO-7 (below) will protect it from impacts of siltation and erosion.

4. Point Reyes bird's-beak (*Cordylanthus maritimus palustris*).

This species is listed as a CNPS 1B plant. It is found in coastal salt marshes and has been recorded within 5 miles of the site (CNDDB 2001). This is another annual herb, and flowering time is June to October.

No Point Reyes bird's-beak has been found in the levee restoration site (Ryan and Falco 1998, TRA 2001). This plant has been extirpated from Santa Clara County and the north bank of San Francisquito Creek (SCVWD, 2002). Mitigation Measure BIO-1 will ensure that the soil compaction method will not be used at the base of the levee in areas where Point Reyes bird's-beak is growing, and Mitigation Measure BIO-7 (below) will protect it from impacts of siltation and erosion.

5. California seablite (*Suaeda californica*).

This perennial species is listed as a CNPS 1B plant. It is found in the margins of coastal salt marshes and in the upper intertidal marsh zone (Corelli and Chandik 1995). This species flowers from July to October. California seablite is an extremely rare shrub in the San Francisco Bay Area. Since its distinctive foliage was not observed during the November survey (TRA 2001), it is unlikely to be present in the saltmarsh transition zone of the site and will thus not be impacted by the project. This plant has been extirpated from Santa Clara County and the north bank of San Francisquito Creek (SCVWD, 2002).

FLOODWALL DEMOLITION AND RECONSTRUCTION

San Francisquito Creek is tidal through the entire floodwall reconstruction site. Therefore, the floodwall project site does not contain suitable habitat for sensitive freshwater species that occur upstream of the project sites. However, as stated above, San Francisquito Creek is critical habitat for the federally threatened Central California Coast Steelhead Evolutionary Significant Unit (ESU), which could be impacted during the construction phase of the Floodwall Demolition And Reconstruction Project. No impacts will occur after the project is completed, as work in the creek is only associated with the proposed construction activities. After completion, no work will occur in the creek.

The closest sighting of any steelhead near the project site is of outmigrant steelhead above the small dam near Clarke Avenue. Steelhead stay in the system often until there is no more water for passage, waiting for a late rain. They may be there as late as June in a very wet year but are usually gone by the end of April (J. Johnson pers. comm.). The floodwall project should not have potential impacts on steelhead, because the work is expected to start after June 15, which is generally after the surface flow for the entire length of creek has stopped for the season (A. Launer, G. Stern, pers. comm.). However, because the creek channel will be dewatered during the project, native aquatic vertebrates may become stranded. The following mitigation measures will reduce or avoid impacts of the construction phase of the project.

Mitigation Measure BIO-5: Salvage native aquatic vertebrates from dewatered portions of the creek. If fisheries or native aquatic vertebrates are present when the cofferdams for the floodwall portion of the project are to be installed, a steelhead and native aquatic vertebrate relocation plan will be implemented by a qualified biologist to ensure that fish and native aquatic vertebrates are not stranded. The biologist shall be present during the installation of the cofferdam and the creek dewatering process. Moving animals will be consistent with applicable USFWS and California Department of Fish and Game (CDFG) permits. Invasive non-native species will not be transferred due to their harm to the aquatic ecosystem. Native aquatic invertebrates similarly will not be transferred, but are expected to be abundant and will recolonize the site after completion of the repair work.

Implementation:	District
Timing:	Throughout construction phase
Fiscal responsibility:	JPA Member Agencies
Monitoring:	San Mateo County Department of Public Works

Mitigation Measure BIO-6: Restore Configuration of Channel Bottom. The contractors shall re-grade all portions of the channel bottom at the end of the work project to be as close to pre-construction conditions as possible.

The depth and size of the low flow channel shall emulate the pre-construction conditions as closely as possible within the finished channel topography. Temporary fills, such as for access ramps, diversion structures, or cofferdams, shall be completely removed upon finishing the work.

As part of this mitigation measure, a qualified biologist shall provide adequate photo documentation of the sites before, during and after construction. Creekbed restoration work shall be approved by the District prior to project initiation to ensure that the contractor is aware of the existing condition of the site, so that the City of East Palo Alto, SCVWD and the contractor can know what condition the site shall be returned to upon project completion. Determination of adequacy of the photos for this measure shall be determined by a representative of the County's Environmental Services Division.

Implementation:	District
Timing:	Throughout construction phase
Fiscal responsibility:	JPA Member Agencies
Monitoring:	San Mateo County Department of Public Works

b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?

Less Than Significant Impact With Mitigation Incorporation.

LEVEE RESTORATION.

The Levee Restoration area contains one sensitive natural community: the Northern coastal salt marsh. This section contains a discussion of the possible impacts to this sensitive natural community:

Northern coastal salt marsh

The patches of pickleweed saline/saltmarsh habitat on and adjacent to the levee site are known as northern coastal salt marsh. This sensitive marsh provides food, cover, nesting and roosting habitat for a variety of birds, mammals, reptiles and amphibians. Birds endemic to the San Francisco Bay marshlands include the endangered California clapper rail, California black rail, salt marsh yellowthroat and three subspecies of the song sparrow. Other bird species that feed or roost in these wetlands include herons, egrets, ducks, hawks, Virginia rails, American coots, shorebirds, swallows, and marsh wrens. Characteristic mammals of northern coastal salt marsh found around San Francisco Bay include species of shrews, bats, and mice, including the endemic endangered salt marsh harvest mouse and the other special status species of concern (i.e., salt marsh wandering shrew), as well as raccoon, mink, and river otter.

This plant community could be negatively impacted during the project construction through erosion and sedimentation. The construction methodology was chosen to protect these plant communities. The compacted earth method requires the clearing of vegetation on the sides of the levee and will expand the sides of levee footprint a maximum of 5 feet. In order to avoid significant impact to this community, the following mitigation measures will be implemented:

Mitigation Measure BIO-7: Erosion and sediment control measures to avoid the flow of sediment into sensitive pickleweed salt marsh community. Sediment retention measures such as silt fencing, straw bales, and straw or coir wattles shall be installed on the side of the levee that has pickleweed salt marsh community for the entire length of the project, to prevent any loose material from falling or sliding into the creek during the construction process. Sediment retention measures, most likely silt fencing in this case, shall also be installed on the outboard side of the levee slopes where use of reinforced earth is planned. All sediment retention measures installed shall be maintained in accordance with the manufacturer's recommendations and/or with the installation and maintenance recommendations provided in the California Storm Water BMP Handbook. Proper removal and disposal of collected sediments and fencing shall be achieved upon completion of project construction. Water will not be allowed to drain directly into the creek channels.

Implementation:	District
Timing:	Throughout construction phase, whenever applicable
Fiscal responsibility:	JPA Member Agencies
Monitoring:	San Mateo County Department of Public Works

FLOODWALL DEMOLITION AND RECONSTRUCTION

The potential impacts of floodwall construction on special status species are addressed above in Section IVa. The potential impacts of levee-raising and floodwall demolition and reconstruction on breeding birds in the riparian habitat are addressed below in IVd. The following is a discussion of the impacts to the special habitats in the Floodwall Demolition and Reconstruction project site area, which consist of Creek Channel Habitat and Shaded Riverine Habitats:

1) Creek Channel Habitat

The San Francisquito Creek channel is sensitive habitat because it is riparian and because it contains in-channel wetlands (Lyons 2001a). Although the project will take place in the dewatered creek channel and on top of 0.17 acres of delineated wetlands, it will have a less than significant impact on these sensitive resources with the implementation of the following mitigation measures:

Measure BIO-6: Restore configuration of channel bottom. (see description of this measure above).

Measure BIO-8: The contractor shall use equipment that minimizes disturbance to the stream bottom. Appropriately-tired vehicles, either tracked or wheeled, shall be used depending on the situation.

Implementation:	District
Timing:	Throughout construction phase
Fiscal responsibility:	JPA Member Agencies
Monitoring:	San Mateo County Department of Public Works

2) Riparian and Shaded Riverine Area (SRA) Habitat

The riparian woodland in the floodwall project is a sensitive natural community. In previously disturbed areas along the creek, the riparian corridor is vegetated with coyote brush (*Baccharis pilularis*), myoporum (*Myoporum* sp.), and blue elderberry (*Sambucus mexicana*) (Lyons 2001a). In more natural areas, native tree species, such as Fremont cottonwood (*Populus fremontii*), willow (*Salix* sp.), white alder (*Alnus rhombifolia*), and Oregon ash (*Fraxinus* *latifolia*) are abundant along the creekbanks and were observed growing along the lower banks of the creek channel (ibid.). Native and non-native upland tree species occur along the upper slopes and top-of-bank areas and intermix with the more mesic lower-bank riparian vegetation; typical species include Monterey pine (*Pinus radiata*), eucalyptus (*Eucalyptus* sp.), coast live oak (*Quercus agrifolia*), California bay (*Umbellularia californica*), acacia (*Acacia* sp.), and Douglas fir (*Pseudostuga menziesii*) (Ibid.). The understory is dominated by non-native herbaceous plants, including wild oat (*Avena* sp.), Italian ryegrass (*Lolium multiflorum*), horehound (*Marrubium vulgare*), poison hemlock (*Conium maculatum*), mallow (*Malva neglecta*), and Himalaya berry (*Rubus procerus*) (ibid.). The native plants mugwort (*Artemisia douglasiana*), creek clematis (*Clematis ligusticifolia*), and California blackberry (*Rubus ursinus*) also occur (Ibid.).

Woody vegetation that overhangs the creek channel provides cover and/or shade for aquatic resources. The amount of potential shaded riverine aquatic habitat is measured as the number of linear feet of vegetative cover over the creek channel. A total of approximately 1,750 linear feet of riparian habitat was documented overhanging the creek bed from Hwy. 101 to Newell Road (Lyons 2001a). This habitat was most evident in the upstream portion of the study area and is provided by several tree species, including Fremont cottonwood, willow, coast live oak, California bay, and California buckeye (*Aesculus californica*) (Ibid.). Floodwall construction may affect the amount of potential shaded riverine aquatic habitat depending upon the site construction work and the final design of the floodwalls. In order to ensure that woody vegetation is not reduced significantly by floodwall construction activities, the following mitigation measure shall be implemented. Implementation of this mitigation measure will reduce potential impacts to SRA to less than significant levels.

Mitigation Measure BIO-9: Avoid impacts to native tree species. Removal of existing native trees shall be prohibited unless the tree is demonstrated to be unhealthy, diseased or unsafe by a qualified arborist, or is less than 11.5 inches in diameter. Oaks and other native trees to be retained that are located in or near the planned construction area must be fenced in order to protect them against inadvertent damage during grading and construction. The dripline of oak trees shall be entirely fenced.

Implementation:	District
Timing:	Throughout construction phase, whenever applicable
Fiscal responsibility:	JPA Member Agencies
Monitoring:	San Mateo County Department of Public Works

c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?

Less Than Significant Impact with Mitigation Incorporation.

LEVEE RESTORATION

The Santa Clara County levee will be raised through placing reinforced earth on top of the existing levees of the creek. The San Mateo County levee will be raised through application of both the reinforced earth and the compacted earth methods. The compacted earth method has the potential to impact wetlands and special status plants because it will result in the expansion of the levee footprint and requires the clearing of vegetation from the outboard levee slope. This method will be used only in areas where wetland along the outboard toe of the slope is absent. Application of mitigation measures BIO-7 and BIO-8 will ensure that wetlands will not be impacted during the levee restoration project and that where wetlands and sensitive plant species are present, the reinforced earth method shall be used.

FLOODWALL DEMOLITION AND RECONSTRUCTION

The floodwall demolition and reconstruction may take place from the creek bed. Currently, there are creekbed sediment deposits supporting in-creek wetlands, with approximately 0.85 acre within the floodwall project area. The floodwall project area, between Hwy 101 and Rhodes Drives, is tidally influenced. Floodwall construction activities will occur in jurisdictional areas considered Waters of the United States (i.e., open water/creekbed below Mean High Water/ Ordinary High Water and wetlands) (Lyons 2001a).

Implementation of Mitigation Measures BIO-5 and BIO-6 will reduce impacts on the creek bed to less than significant levels. See above discussion for a complete description of this mitigation measure.

d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?

Less Than Significant Impact with Mitigation Incorporation.

The project does not propose any permanent structures that would interfere with movement along San Francisquito Creek or its levees. All potential impacts to wildlife corridors and movements associated with the construction phase of the project are considered temporary. Wildlife would avoid moving through construction sites while crews are actively working, and crews would only be working during the day and the construction period is expected to extend for a maximum of 5 months. Thus, potential impacts to wildlife corridors and wildlife movement are temporary and not considered significant. The following is a complete discussion of potential impacts:

LEVEE RESTORATION

The proposed project schedule overlaps with the nesting season for birds. Project construction will temporarily disrupt foraging and nesting activities of bird species that intermittently, seasonally and/or temporarily use the creek and adjacent areas, including migratory birds. Since this is a temporary disruption, this is not considered significant given the amount of area baylands that are protected in open space in the immediate vicinity, including the Palo Alto Baylands Nature Preserve further east and south of the site.

Raptors (e.g., hawks and owls) and migratory birds are likely to breed in the shrubs and trees within the San Francisco Creek riparian corridor. Suitable habitat for these birds could be disturbed by the project's construction. Construction disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings, or otherwise lead to nest abandonment, which would be a significant impact. The application of the following mitigation measure will reduce this potential impact to less than significant levels.

Mitigation Measure BIO-10: Project construction could cause the loss of active bird nests or young. To avoid impacts to breeding birds (including raptors and migratory birds), preconstruction surveys shall be conducted and avoidance measures shall be implemented if necessary. No project activities that could cause nest abandonment shall occur prior to the surveys. A qualified biologist shall conduct the survey no more than 30 days prior to the initiation of project construction.

If nesting activity is discovered, the biologist shall determine the extent of a construction free buffer zone (typically 250 feet) to be established around the nest. No disturbance that could cause nest abandonment would occur within that buffer zone until the biologist has determined that all breeding activity has concluded for the season and young (if any) have fledged.

Implementation:	District
Timing:	No more than 30 days prior to start of work.
Fiscal responsibility:	JPA Member Agencies
Monitoring:	San Mateo County Department of Public Works

FLOODWALL DEMOLITION AND RECONSTRUCTION

Although work will be conducted from the streambed, there will be no affect upon steelhead migration because construction will not be taking place during the winter months (November through May). Cofferdams will only be present during the non-migration period, between June 15 and October 15. Mitigation Measure BIO-7: Restore Configuration Of Channel Bottom addresses the restoration of the streambed to ensure that there are no changes to the steelhead migration corridor as a result of the project. Implementation of these Mitigation Measures will reduce potential impacts to less than significant levels.

e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?

Less Than Significant Impact. The following is a discussion of relevant policies for both the Cities of both East Palo Alto and Palo Alto:

City of East Palo Alto Policies and Ordinances

This proposed flood control project is consistent with both the City of East Palo Alto Zoning Ordinance (1995) and the EPA General Plan as the San Mateo County side of the levee (within the Palo Alto Baylands Nature Preserve) is in an area zoned for resource management.

The proposed project would be consistent with all of the relevant City of East Palo Alto General Plan Natural Resources Issues, Goals and Policies and with the Conservation and Open Space Element Implementation Program (COS). Specific relevant policies are listed below.

Policy 2.1: Conserve, protect and maintain important natural plant and animal communities, such as the baylands, Cooley Landing, San Francisquito Creek, the shoreline and significant tree stands.

Policy 2.2: Conserve and protect important watershed areas and soils through appropriate site planning and grading techniques, revegetation and soil management practices, and other resource management techniques.

Policy 2.3: Preserve existing and increase the number of trees within the community.

Policy 2.4: Maximize enjoyment and promotion of natural resource areas, such as the baylands, Cooley Landing, San Francisquito Creek, and the shoreline.

COS-2: Assess public and private development proposals for impacts to natural resources (water, plant and animal habitat, large trees and soil) and require feasible mitigation.

City of East Palo Alto Tree Ordinance

The project is consistent with the following policies as listed in the East Palo Alto Tree Ordinance. The ordinance requires a permit prior to removing:

1. Any tree having a main stem or trunk which measures 40 inches or greater in circumference at a height of 24 inches above natural grade

2. Any tree within a public street or public right of way, regardless of size.

Although the project will not conflict with local policies and regulations regarding tree protection, the following mitigation measure, in accordance with the City of East Palo Alto tree ordinance, is recommended to ensure that native tree species are not damaged during construction. By protecting native tree species from removal and excessive pruning with Measure BIO-12, the riparian canopy over San Francisquito Creek will be protected.

City Of Palo Alto Policies And Ordinances

The project will not destroy native plants and will result in minimal trimming of vegetation. The project will not cause soil disturbance that will encourage new non-native plant growth. The project will not be result in the planting any new plants, native or non-native. Further, the project will not change riparian habitat value and functions. Thus, the project is consistent with the following policies as listed in the Palo Alto Comprehensive plan:

POLICY N-1:
Manage existing public open space areas and encourage the management of private open space areas in a manner that meets habitat protection goals, public safety concerns, and low impact recreation needs.

POLICY N-3:
Protect sensitive plant species resources from the impacts of development.

POLICY N-8:
Preserve and protect the Bay, marshlands, salt ponds, sloughs, creeks, and other natural water or wetland areas as open space.

POLICY N-10:
Work with the Santa Clara Valley Water District and other relevant regional agencies to enhance riparian corridors and provide adequate flood control by use of low impact restoration strategies.

POLICY N-11:
Preserve the integrity of riparian corridors.

POLICY N-12:
Preserve the habitat value of creek corridors through the preservation of native plants and the replacement of invasive, non-native plants with native plants.

POLICY N-13:

Discourage creek bank instability, erosion, downstream sedimentation, and flooding by minimizing site disturbance and vegetation removal on or near creeks and carefully reviewing grading and drainage plans for development near creeks and elsewhere in the watersheds of creeks.

POLICY N-17:

Preserve and protect heritage trees, including native oaks and other significant trees, on public and private property.

POLICY N-22:

Limit the amount of impervious surface in new development or public improvement projects to reduce urban runoff into storm drains, creeks, and San Francisco Bay.

City of Palo Alto Tree Ordinance

The project is consistent with the following policies as listed in the Palo Alto Tree ordinance. The ordinance:

1. Requires protection of coast live oak trees that are 11.5 inches in diameter or larger (as measured from 4.5 feet from grade) and redwood trees that are at least 18 inches in diameter.

2. Prohibits excessive pruning of any woody plant which has a trunk four inches or more in diameter at four and one-half feet above natural grade level. Excessive pruning is defined as more than ¼ of the functioning leaf and stem area of a tree.

Although the project will not conflict with local policies and regulations regarding tree protection, the following mitigation measure, in accordance with the City of Palo Alto tree ordinance, is recommended to ensure that native tree species are not damaged during construction. By protecting native tree species from removal and excessive pruning with Measure BIO-12, the riparian canopy over San Francisquito Creek will be protected.

f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?

No Impact. There are no Habitat Conservation or Natural Community Conservation Plans for the project area. The project area and/or San Francisquito Creek have been included in recent area studies, including the *Baylands Ecosystem Habitat Goals* study (San Francisco Bay Area Wetlands Ecosystem Goals Project, 1999), in which wetland habitat restoration goals and opportunities are identified for lands throughout the San Francisco Baylands.

The *San Francisquito Creek Bank Stabilization and Revegetation Master Plan* was completed in September 2000 as a joint effort between the Cities of Menlo Park, Palo Alto, and East Palo Alto, San Mateo County Flood Control District and the Santa Clara Valley Water District in response to the record flows of February 1998 and desires to develop bank stabilization measures. The study includes an approximate 6.5-mile reach of the creek upstream of Highway 101. The purpose of the plan is:

- To preserve and/or enhance the natural character of San Francisquito Creek by increasing the presence of native vegetation. This will improve habitat value, water quality, and bank stability – while protecting or improving creek conditions for state and federally listed species.
- To stabilize banks in an environmentally sensitive manner that protects property and infrastructure, without significantly changing the conveyance of the creek.
- To enhance the value of the creek as a community amenity by improving access to public areas, enhancing interpretive and education opportunities, and improving visual connections.
- To develop a unified approach to implementation of the Plan that promotes consistency across jurisdictional boundaries and streamlines permitting process for participating landowners (Royston Hanamoto Alley & Abey et.al. September 2000).

The plan includes the upstream portion of the project site, upstream of Highway 101. However, the plan is targeted toward bank stabilization and revegetation measures, and does not address flood management issues, as does the proposed project.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
V. CULTURAL RESOURCES -- Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☐	☒	☐	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☒	☐	☐
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☒	☐	☐
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☒	☐	☐

Discussion:

Would the project:

a-d a) Cause a substantial adverse change in the significance of a historical resource as defined in 15064.5; b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to 15064.5; c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature; or, d) Disturb any human remains, including those interred outside of formal cemeteries?

Less than Significant Impact with Mitigation Incorporation. The upstream portion of the site in the area of Highway 101 is identified as being within a sensitive archaeological area in the City of Palo Alto Comprehensive Plan (Map L-8). Studies conducted in the city of East Palo Alto indicate evidence of archaeological resources along the San Francisco Bay margins and along San Francisquito Creek more than one mile upstream of the project area (City of East Palo Alto, October 1999).

The project site has been previously disturbed with construction of the levees in 1958. The addition of engineered fill to raise the levee height back to their original design elevation will not result in subsurface excavation or further ground disturbances. Thus, the likelihood of affecting an archaeological or paleontological resource is low. While the likelihood of finding archaeological resources is low because the site is disturbed, the following mitigation measure will be implemented if any cultural remains are historic artifacts are discovered:

MITIGATION CUL-1: Discovery of Cultural Remains or Historic Artifacts

Work in areas where remains or artifacts are found will be restricted or stopped until proper protocols are met.

1. Work at the location of the find will halt immediately within 30 feet of the find. If an archaeologist is not present at the time of the discovery, either SCVWD or the City of East Palo Alto (depending on the location) will contact an archaeologist for identification and CEQA evaluation.
2. If the find is not significant, construction can continue. The archaeologist will prepare a brief informal memo/letter that describes and assesses the significance of the resource, including a discussion of the methods used to determine significance for the find.
3. If the find appears significant, the archaeologist will determine if the resource can be avoided and will detail avoidance procedures.
4. If the resource cannot be avoided, the archaeologist will develop within 48 hours an Action Plan to avoid or minimize impacts. The contractor will not proceed until the Action Plan is approved by the City of East Palo Alto or SCVWD.
5. The recovery effort will be detailed in a report prepared by the archaeologist in accordance with current archaeological standards. Any non-grave artifacts will be placed with an appropriate repository.
6. In the event of discovery of human remains, the field crew supervisor shall take immediate steps to secure and protect such remains.
7. The Santa Clara County Coroner or San Mateo County Coroner shall be notified and informed of the find and of any efforts made to identify the remains as Native American. If the remains are determined to be from a prehistoric Native American, the medical examiner is responsible for contacting the Native American Heritage Commission (NAHC) within 24 hours of notification. The NAHC then designates and notifies within 24 hours a *Most Likely Descendant* (MLD). The MLD has 24 hours to consult and provide recommendations for the treatment or disposition, with proper dignity, of the human remains and grave goods.
8. Preservation in situ is the preferred option, and if the SCVWD and the City of East Palo Alto can do this without incurring potential future disturbance, then the MLD will usually recommend no further action. The remains and artifacts will be documented and the find location carefully backfilled to avoid further disturbance.

Human remains or cultural items exposed during maintenance that are subject to further disturbance will be exhumed archaeologically at the discretion of the MLD and reburied with the concurrence of the MLD in a place mutually agreed upon by all parties.

Implementation:	District
Timing:	Throughout construction phase, whenever applicable
Fiscal responsibility:	JPA Member Agencies
Monitoring:	San Mateo County Department of Public Works

	Potentially Significant Impact	**Less Than Significant with Mitigation Incorporation**	**Less Than Significant Impact**	**No Impact**
VI. GEOLOGY AND SOILS -- Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☐	☒
ii) Strong seismic ground shaking?	☐	☐	☒	☐
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☒	☐
iv) Landslides?	☐	☐	☐	☒
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☒	☐
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☒	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☒	☐
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒

Discussion:

Would the project result in:

a i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.

No Impact. The project site is located between the San Andreas, Hayward and Calaveras Fault zones, but there are no known active faults on or adjacent to the project site, and therefore, fault rupture is not anticipated (City of Palo Alto, July 1998).

ii) Strong seismic ground shaking?
iii) Seismic-related ground failure, including liquefaction?

Less than Significant Impact. As indicated above, the project site is located near three major fault zones—the San Andreas, the Hayward and Calaveras faults. According to the City of Palo Alto General Plan (Map N-10), the project site is located in an area subject to "violent" seismic shaking. According to the City of Palo Alto General Plan (Map N-5), the project site is located in an area with a high potential for liquefaction. The northwest-trending San Andreas Fault is located about 5 miles southwest of the site; the estimated maximum credible earthquake in the project vicinity is 8.25 (City of East Palo Alto, October 1999). The Hayward Fault zone is located approximately 9 miles northeast of the project site on the east side of the San Francisco Bay. The Calaveras Fault branches from the San Andreas Fault to the south, and passes approximately 16 miles northeast of the site (Earth Systems Consultants, November 1983).

A geotechnical investigation conducted for a portion of the Baylands Trail that traverses the creek levee in the project area found that the project site is located near the boundary between recent bay deposits (Bay Mud) and Holocene alluvial soil deposits along the western edge of San Francisco Bay (Earth Systems Consultants, November 1983). Soils borings in the levee area found 6 to 11 feet of stiff to hard, brown silty clay fill over natural soils, and concluded that the soils are only moderately compressible (Ibid.). The Bay Mud underlying the fill was found to be compressible (Ibid.).

Past geotechnical analyses to assess the generally stability of the existing levees and the stability with placement of fill to approximately 10 feet above MSL along the levees indicate that the compressible Bay Mud soils have consolidated over time and have gained some strength due to the placement of fill for the levees. The stability of the slopes is such that only localized sloughing along the edges of the levees was predicted under moderate to strong seismic shaking (Earth Systems Consultants, November 1983). The geotechnical review for a portion of the Baylands Trail found that the placement of fill material could result in some consolidation of existing compressible soils (Ibid.).

The project will add engineered compacted soil and reinforced earth to the top of an existing levee. The material will be engineered according to standards employed by SCVWD, which take into account seismic and static loading conditions. The underlying levee was constructed in 1958. According to SCVWD's senior geotechnical engineer, the existing levee and its foundation have gained strengths over the years due to the consolidation process (settlement). That means that at the present time the existing levee should have a greater seismic stability than when originally constructed, and adding one or two feet of compacted fill with a 2:1 outboard slope or soil reinforcement, should not impact the structural stability of the levee with respect to seismic loading. (Khan, personal communication to Weese, January 2001). However, the structural stability and condition of the existing levee with respect to seismic groundshaking and settlement is not known.

iv) Landslides?

No Impact. Except for the San Francisquito Creek levees, the surrounding area is located on flat terrain and not within hillside or other areas subject to landslides.

b) Would the project result in substantial soil erosion or the loss of topsoil?

Less than Significant Impact. The project will require importation of approximately 7,000 cubic yards of engineered fill material for raising the existing levee height. BMPs are incorporated into the project design to prevent sediments from being deposited into the adjacent San Francisquito Creek channel and to prevent erosion (as listed in subsection 2.3). Implementation of all of these BMPs will reduce or avoid potentially significant impacts so that no substantial soil erosion or loss of topsoil will occur.

c) Would the project be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?

Less than Significant Impact. See subsections b) and c) above.

d) Would the project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?

Less than Significant Impact. See subsections b) and c) above.

e) Would the project have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

No Impact. The proposed project is a flood control maintenance activity and does not result in construction of permanent development that requires septic systems.

	Potentially Significant Impact	**Less Than Significant with Mitigation Incorporation**	**Less Than Significant Impact**	**No Impact**
VII. HAZARDS AND HAZARDOUS MATERIALS -- Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☒	☐	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☒	☐	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☒	☐
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
h) Expose people or structures to a significant risk of loss, injury or death	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?				

Discussion:

Would the project:

a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?
b) Create a significant hazard to the public or the environmental through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?

Less than Significant Impact with Mitigation Incorporation. The project does not involve the transport, use or disposal of hazardous materials or wastes and would not result in creation of a public health hazard. However, because the project involves both the use of heavy equipment and the use of the heavy equipment in creeks, the following Mitigation Measures will apply:

MITIGATION HAZ-1: The SCVWD and the City of East Palo Alto shall prevent the accidental release of chemicals, fuels, lubricants, and non-storm drainage water into San Francisquito Creek during project construction.

- SCVWD field personnel will be appropriately trained in spill prevention, hazardous material control, and clean-up of accidental spills.
- No fueling, repair, cleaning, maintenance, or vehicle washing shall be performed in the creek channel or in areas at the top of the channel bank that may flow into the creek channel.

Spill prevention kits shall always be in close proximity when using hazardous materials (e.g., crew trucks and other logical locations).

Implementation:	City of East Palo Alto and SCVWD
Timing:	Throughout construction phase, whenever applicable
Fiscal responsibility:	JPA Member Agencies
Monitoring:	San Mateo County Department of Public Works

MITIGATION HAZ-2: No fueling shall be done in the San Francisquito stream channel or immediate floodplain, unless equipment stationed in these locations is not readily relocated i.e., pumps, generators. For stationary equipment that must be fueled on site, such as the pumps for the floodwall construction, containment will be provided in such a manner that any accidental spill of fuel will not be able to enter the water or contaminate sediments that may come in contact with water. Any equipment that is readily moved out of the channel will not be fueled in the channel or immediate floodplain. All fueling done at the job site will provide containment to the degree that any spill will be unable to enter the channel or damage stream vegetation.

Replacement of engine fluids, when necessary, shall be done outside of the channel area. Fluids will be collected in drip pans, stored in appropriate containers, and properly recycled or disposed of offsite. All equipment fluids shall be stored in a secure area away from the channel. Quantities greater than 55 gallons will be provided with a secondary containment capable of containing 110 percent of the primary container.

Implementation:	City of East Palo Alto and SCVWD
Timing:	Throughout construction phase, whenever applicable
Fiscal responsibility:	JPA Member Agencies
Monitoring:	District, through the County's Public Works Department

MITIGATION HAZ-3: No equipment servicing shall be done in the stream channel or immediate floodplain, unless equipment stationed in these locations cannot be readily relocated i.e., pumps, generators.

- Any equipment that can be readily moved out of the channel will not be serviced in the channel or immediate floodplain.
- All servicing of equipment done at the job site will provide containment to the degree that any spill will be unable to enter the channel or damage stream vegetation.
- If emergency repairs are required in the field, only those repairs necessary to move equipment to a more secure location will be done in the channel or floodplain.
- If emergency repairs are required, containment will be provided equivalent to that done for fueling or servicing.

Implementation:	City of East Palo Alto and SCVWD
Timing:	Throughout construction phase, whenever applicable
Fiscal responsibility:	JPA Member Agencies
Monitoring:	San Mateo County Department of Public Works

c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within ¼ mile of an existing or proposed school?

Less than Significant Impact. The construction activities associated with the proposed Levee Restoration and Floodwall Reconstruction project will not result in hazardous emissions other than basic carbon monoxide from the vehicle's exhaust pipes. The use of these vehicles will be only during the construction phase of the project, thus the project will not cause a permanent increase in vehicle emissions. There is a private school (International School of the Peninsula at 151 Laura Lane) within 1/4 mile of the project site, but the project will have no impact on this school, as the project does not involve use or emission of hazardous materials or substances.

d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?

No Impact. The project site is not located on a hazardous material site.

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?

f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?

No Impact. The project site is located within one-half mile of the Palo Alto Airport. The airport does not provide commercial air service. The project will not result in new development or permanent population. The number of construction workers at the project will be limited to approximately 20 for a short-term duration (3-5 months), and workers would not be subjected to significant hazards due to the proximity of this airport.

g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

No Impact. The proposed levee project is confined to the top of the existing levee and in some areas on the outboard slopes. The existing levee top is paved in some areas on the southern side, and is used by bicyclists and pedestrians (see discussion in Recreation, below). The levee is not used for emergency response or evacuation. The project will not result in permanent changes to traffic and circulation, although there will be a less-than-significant temporary increase in construction-related traffic for workers and materials to access the site (see discussion in Traffic, below). The project will have no effect on emergency response or evacuation plans.

h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

No Impact. The proposed project is confined to the top of the levee and in some areas on the outboard slopes. The project site is located within an urban area and is not located near wildlands.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
VIII. HYDROLOGY AND WATER QUALITY -- Would the project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☒	☐	☐
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☒	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	☐	☐	☒	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☐	☐	☒	☐
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☒	☐
f) Otherwise substantially degrade water quality?	☐	☒	☐	☐
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒

h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☐	☐	☒
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☒	☐
j) Inundation by seiche, tsunami, or mudflow?	☐	☐	☒	☐

Discussion:

Would the project:

a) Violate any water quality standards or waste discharge requirements; or, f) Otherwise substantially degrade water quality?

Less Than Significant Impact with Mitigation Incorporation.

LEVEE RESTORATION

The Levee Restoration portion of the project consists of raising the elevation of existing levees by adding compacted soil. No work is planned within the creek channel or on the inboard side of the levee. To prevent erosion or other debris from entering the creek, the project includes the following mitigation measure:

MITIGATION HYD-1: Sediment retention measures such as silt fencing, straw bales, and straw or coir wattles shall be installed on both sides of the levee for the entire length of the project, to prevent any loose material from falling or sliding into the creek during the construction process. Sediment retention measures, most likely silt fencing in this case, shall also be installed on the outboard side of the levee slopes where use of reinforced earth is planned. All sediment retention measures installed shall be maintained in accordance with the manufacturer's recommendations and/or with the installation and maintenance recommendations provided in the California Storm Water BMP Handbook. Proper removal and disposal of collected sediments and fencing shall be achieved upon completion of project construction. Water will not be allowed to drain directly into the creek channels.

Implementation:	City of East Palo Alto and SCVWD
Timing:	Throughout construction phase, whenever applicable
Fiscal responsibility:	JPA, through member agencies
Monitoring:	San Mateo County Department of Public Works

MITIGATION HYD-2: No debris, soil, silt, sand, cement, concrete, or washings thereof, or other construction related materials or wastes, oil or petroleum products or other organic or earthen material shall be allowed to enter into or be placed where it may be washed by rainfall or runoff into channel or stream waters, or into the delineated wetland areas on the outside of the creek levees.

Implementation: City of East Palo Alto and SCVWD
Timing: Throughout construction phase, whenever applicable
Fiscal responsibility: JPA, through member agencies
Monitoring: San Mateo County Department of Public Works

FLOODWALL DEMOLITION AND RECONSTRUCTION

MITIGATION HYD-3: For tidal areas, a downstream cofferdam will be constructed to prevent the work area from being inundated by tidal flows. By isolating the work area from tidal flows, water quality impacts will be minimized.

- Installation of cofferdams will begin at low tide.
- Cofferdams in tidal areas can be made from earthen material. If earth is used, the downstream and upstream faces shall be covered by a protected covering (e.g., plastic or fabric) if needed to minimize erosion.

Implementation: City of East Palo Alto and SCVWD
Timing: Throughout construction phase, whenever applicable
Fiscal responsibility: JPA, through member agencies
Monitoring: San Mateo County Department of Public Works

MITIGATION HYD-4: All temporary diversion structures shall be removed within 48 hours of completion of work. Flows shall be restored in a manner that minimizes erosion. When diversion structures are removed, to the extent practicable, the ponded flows will be directed into the low-flow channel within the work site to minimize downstream water quality impacts.

Flows shall gradually be restored to the channel to avoid a surge of water that would cause erosion or scouring. Bypassed flows can be slowly reintroduced into the dewatered area by leaving a silt barrier in place to allow water to slow and drop sediment to the extent possible.

Mitigation Measures HAZ-01, HAZ-02 and HAZ-03 are also proposed to prevent fueling of equipment on the levee. All materials will be properly contained and stored in the designated construction staging areas that are located outside of the channels and levee area. Thus, potential water quality degradation from construction activities will be avoided.

Implementation: City of East Palo Alto and SCVWD
Timing: Throughout construction phase, whenever applicable
Fiscal responsibility: JPA, through member agencies
Monitoring: San Mateo County Department of Public Works

b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local ground water table level (for example, the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?

Less Than Significant Impact. The proposed Levee Restoration and Floodwall Reconstruction activities do not permanently entail the withdrawal of groundwater, interception of an aquifer, or changes to groundwater recharge capability. However, the dewatering/cofferdam operation for the Floodwall Demolition and Reconstruction portion of the project could lower the existing water table by pumping that reach of creek and groundwater resources in that area. This would be a temporary, construction-related condition that would not permanently affect groundwater resources.

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?

Less Than Significant Impact. Raising the existing levee elevation by 0.5 to 2.64 feet and demolishing and reconstructing a floodwall adjacent to the creek does not involve constructing new impervious surfaces, changing the vegetative cover of land in the upper watersheds, or compacting large areas of soil that could change soil infiltration rates and alter drainage patterns. Nor would the project create barriers to drainage patterns. By restoring the height of the existing levee elevation, additional water will be contained within the creek channel. Additional water will be contained within the creek channel by demolishing the existing floodwall, constructing a new one in its place, and adding another level of the sacked concrete to the top of 300 feet of the existing wall above the wall length to be demolished. The project is to restore the levee to its original design as constructed in 1958 and to demolish an existing floodwall and reconstruct a new wall in its place. The project will not permanently impact absorption rates, drainage patterns, or the rate and amount of surface water runoff. However, it is possible that some temporary impacts may occur, resulting from the installation and use of cofferdams to dewater the Floodwall Demolition and Reconstruction portion of the site. Since this action would only occur during the construction phase of the project, the effect of this action is less than significant.

d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?

Less Than Significant Impact. San Francisquito Creek is located in the northernmost portion of Santa Clara County and the southernmost portion of San Mateo County. The creek's drainage basin is approximately 45 square miles and covers an area extending from Skyline Boulevard on the ridge of the Santa Cruz Mountains to the San Francisco Bay (San Francisquito Creek CRMP, March 1998). The project site is located in the downstream reach of the creek.

The existing creek levees within the project area between station 80+00 near Highway 101and the pedestrian bridge at Station 31+50 were constructed in 1958 by the Santa Clara Valley Water District and San Mateo County for flood control purposes. The creek channel was also dredged at that time, and with construction of the levee improvements the channel flow capacity was estimated at 7,100 cubic feet per second (cfs) with 1.5 to 2 feet of freeboard (San Francisquito Creek CRMP, March 1998). At that time, the levees were designed to contain a 1% flood.[1]

Since the levees were constructed, a combination of increased siltation of the channel and settlement of the levees has resulted in a decrease in channel capacity. The levee elevations have decreased by 0.5-2.6 feet from their originally constructed condition.

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[1] Protection against a 1% flood event is the design standard required by the Federal Emergency Management Agency (FEMA) for protection of properties within floodplains. A one-percent flood event means that in any given year, there is a one percent chance that this magnitude of a flood will occur. A one-percent flood event is- also referred to as a 100-year flood event.

Flooding has occurred along San Francisquito Creek in the past, the most recent being in February 1998, when the creek overtopped its banks, inundating approximately 11,365 acres in the communities of Palo Alto, East Palo Alto and Menlo Park (Cushing, March 1999). Previous to the February 1998 flooding, the most significant flood on record for the creek occurred in December 1955 with an estimated flow rate of 5,560 cfs, which was considered a 25-year event, meaning that in any given year, this type of event would have a 4% chance of occurring (Cushing, March 1999). The 1998 flood was the most severe for San Francisquito Creek since record keeping began in 1931 and had an estimated flow rate of 7,100 cfs (Ibid.).

FEMA publishes a 1% flow for the project area (downstream of the Chaucer Street Bridge) of 6,000 cfs. This figure is based on substantial overbanking occurring upstream of the project site, which significantly reduces the in-creek flow that arrives at the Highway 101 bridge. FEMA publishes the same flow of 6,000 cfs as the 2% flow (50-year event), because upstream channel capacity limitations restrict the amount of flow that would reach the Highway 101 bridge to 6,000 cfs.

FEMA reports a 1% flow for the creek as 8,070 cfs at the USGS gaging station at the upstream Stanford Golf Course, approximately 10 miles upstream of the project site, increasing to 8,330 cfs upstream of Middlefield road, at which point overbanking reduces the in-creek flow to areas further downstream.

According to calculations by SCVWD (See Appendix B), the existing creek channel capacity along the project reach is estimated to be approximately 3,600 cfs to the top-of-bank. This corresponds to an approximately 5-year return period or 20% storm.[2] Based on an analysis of the 1998 flood conditions, the flow in the creek at the upstream end of the project site was 5,540 cubic feet per second (cfs), which was estimated as a 25-year storm event (Cushing, March 1999). This observed water level was between elevations 16.0 and 16.5 during the 1998 storm at the location just upstream of Highway 101(City of East Palo Alto, October 1999).

The proposed project and restored levee would convey approximately 5,900 cfs, which corresponds to a 15-year return period or 6.5% flow. This flow would reach the top of bank in the area just downstream of Highway 101. The proposed levee restoration will result in an increased water surface elevation, due to the containment of additional flow, compared to what would be conveyed in the channel under conditions that existed before the introduction of the Woodland Creek development and the Levee Restoration Project. The increased water surface elevation will continue upstream of Highway 101. It is estimated that the increased water surface elevation will be 0.5 to 1.0 foot higher than existing conditions, calculated at the 1% flow rate for a distance of approximately 1,100 feet upstream of Highway 101, and about 0.25 feet for another 300 feet upstream. These estimates are based on hydraulic analyses performed by SCVWD, using the HECRAS (Hydraulic Engineering Center's River Analysis System) computer software. The analysis accounts for changes in topography and drainage features that will be implemented as part of the approved residential project located on the north side of the creek, upstream of Highway 101 in the city of East Palo Alto. Technical calculations are included in Appendix B.

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[2] This information is based on the storm event of February 13, 2000, which was gaged at the USGS gaging station at Stanford Golf Course. The preliminary (unpublished) data reported by the USGS indicated a flow of 3,900 cfs at the golf course.

To protect adjacent properties, the project proposes adding to or modifying the existing floodwall along both sides of the channel, which is located upstream of Highway 101, by up to 1.0 foot to compensate for the increased surface water elevation in this area. Additional material will be added on top of the existing floodwall, and/or the floodwall rebuilt in some areas if necessary. Thus, the proposed project would improve flood protection over existing conditions, and with improvement to the floodwall compensate for the slight increase in upstream surface water elevations.

Downstream of the project site, from the pedestrian bridge to the San Francisco bay, the increased confined flow would result in an increased water surface elevation compared to existing conditions. Calculations by SCVWD staff indicate that the increase would be generally less than one-half foot and would be contained within existing levees. This would not adversely affect existing wetlands as discussed in the Biology section.

e) Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff?

Less Than Significant Impact. The proposed construction project would not create or contribute runoff water that would exceed the capacity of existing or planned drainage systems.

g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?

h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?

No Impact. The proposed construction project would not place housing or structures that would impede or redirect flood flows within a 100-year flood hazard area.

i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?

j) Expose people or structures to inundation by seiche, tsunami, or mudflow?

Less Than Significant Impact. The proposed project will not result in construction of permanent habitable structures or development and will not place housing or expose people or structures to flood hazards. The project will result in greater flow capacity within a segment of a creek subject to bank overtopping and flooding of adjacent properties, and thus, increase flood protection.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
IX. LAND USE AND PLANNING – Would the project:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒

Discussion:

Would the project:

a) Physically divide an established community?

No Impact. San Francisquito Creek is an existing landscape feature that is the boundary between Santa Clara and San Mateo Counties. The proposed Levee Restoration and Floodwall Reconstruction work does not result in division of an established community.

b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?

No Impact. There are no known local plans or policies with which the proposed project would be in conflict.

The City of Palo Alto Comprehensive Plan (adopted in 1998) seeks to preserve and protect the Bay, marshlands, creeks and other natural areas (Policy N-8), preserve riparian corridors (Policy N-11), protect native vegetation along creek corridors with replacement of non-native, invasive plants with native plants (Policy N-12). The plan also includes several policies regarding working with the Santa Clara Valley Water District and other regional agencies to provide adequate flood control by use of low impact restoration strategies (Policy N-10), to encourage preservation of riparian habitat (Program N-10), and to develop a comprehensive riparian corridor restoration and enhancement program (Program N-11). The proposed project is consistent with these policies and programs in that the design has incorporated use of reinforced earth to protect existing mature vegetation and trees. There will be no removal of mature riparian or wetland vegetation. See also the Biology section regarding regional plans addressing wetlands and natural resources.

The City of East Palo Alto General Plan (adopted in 1999) contains policies to preserve and enhance important natural resources and features, including plant and animal communities, baylands, shorelines and San Francisquito Creek (Conservation and Open Space Policy 2.1). The Plan also aims to conserve and protect important watershed areas through appropriate site planning, revegetation and soil management practices (Conservation and Open Space Policy 2.2). The General Plan seeks to reduce the risk to the City from hazards associated with flooding by providing and maintaining flood control facilities (Safety Policy 1.2), and identifying flood-prone areas and controlling development in floodway areas. The plan also seeks to cooperate with regional and federal agencies, including the U.S. Fish and Wildlife Service, California Department of Fish and Game and San Mateo County, to promote resource management and protection, and enhance flood control.

c) Conflict with any applicable Habitat Conservation Plan or Natural Community Conservation Plan?

No Impact. See discussion on Biology, above.

	Potentially Significant Impact	**Less Than Significant with Mitigation Incorporation**	**Less Than Significant Impact**	**No Impact**
X. MINERAL RESOURCES -- Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒

Discussion:

Would the project result in:

a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state? Or

b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?

No Impact. The project site is located in a channel that has been previously altered for flood control purposes. The site is are not within, adjacent to, or near mineral resources or mineral resource recovery sites; thus, there is no impact.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
XI. NOISE -- Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☒	☐
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☒	☐
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☒
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☒	☐	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒

Discussion:

Would the project result in:

a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Less than Significant Impact. The project will not result in any permanent increases in ambient noise levels (see answer c below). Thus, no standards established in any local plan or ordinance, or any other applicable standards, will be exceeded on a permanent basis as a result of the project. However, the project will create temporary noise increases during construction.

Relevant ordinances and policies include Policy N-41 of the City of Palo Alto's Comprehensive Plan, the City of Palo Alto's Noise Ordinance, the Noise Element of the City of East Palo Alto's General Plan, and the City of East Palo Alto's Noise Ordinance, all of which serve to protect the public from excessive or potentially excessive noise. Adherence to these ordinances and policies will lessen the intrusiveness of construction noise and will ensure that excessive noise created by the construction process will not significantly impact the surrounding environment and sensitive receptors.

Palo Alto Comprehensive Plan, Noise Element

Policy N-41 of the City of Palo Alto's Comprehensive Plan states that proposed projects subject to CEQA are considered to cause a significant degradation of the noise environment if:

1. "The project would cause the average 24-hour noise level (Ldn) to increase by 5.0 dB or more in an existing residential area, even if the Ldn would remain below 60 dB;
2. The project would cause the Ldn to increase by 3.0 dB or more in an existing residential area, thereby causing the Ldn to exceed 60 dB;
3. The project would cause an increase of 3.0 dB or more in an existing residential area where the Ldn currently exceeds 60 dB."

The 24-hour Ldn measured along the mid-section of the floodwall site on November 19 and 20, 2001, reflecting the noise along San Francisquito Creek at the edge of Palo Alto and East Palo Alto, was 60.5 dB (A-weighted scale). It is likely that each Palo Alto home along the floodwall replacement site will be subjected to temporary noise increases that will raise the Ldn above 63.5 dB. Because the construction will move along the creek, maximum noise impacts to individual houses along both sides of the creek will be limited to a portion of the total project time.

Because this project does not result in permanent noise increases of 3.0 dB or more and its purpose is flood prevention, a matter of public concern, its impact is considered less than significant where the Palo Alto Comprehensive Plan Noise Element is concerned.

City of Palo Alto Noise Ordinance

While the Noise Element is generally used as a planning guideline to advise the approval of proposed permanent projects, the Noise Ordinance is legally enforceable. Applicable noise ordinance sections are discussed below.

Chapter 9.10 of the Palo Alto Municipal Code governs noise sources and levels on residential, commercial, industrial, and public property. All references to dB in this chapter utilize the A-level weighting scale (dBA). The following sections are relevant to the proposed project:

9.10.30 Residential property noise limits.

(a) No person shall produce, suffer or allow to be produced ... on residential property, a noise level more than six dB above the local ambient at any point outside of the property plane.

(b) No person shall produce, suffer or allow to be produced ... on multi-family residential property, a noise level more than six dB above the local ambient three feet from any wall, floor, or ceiling inside any dwelling unit on the same property, when the windows and doors of the dwelling unit are closed.

9.10.050 Public property noise limits.

(a) No person shall produce, suffer or allow to be produced … on public property, a noise level more than 15 dB above the local ambient at a distance of 25 feet or more, unless otherwise provided in this chapter.

(b) Sound performances and special events not exceeding 80 dBA measured at a distance of 50 feet are exempt from this chapter when approval therefore has been obtained.

9.10.060 Special provisions.

(a) General Daytime Exception. Any noise source which does not produce a noise level exceeding 70 dBA at a distance of 25 feet under its most noisy condition of use shall be exempt from the provisions of Sections 9.10.030(a) … and 9.10.050(a) between the hours of 8 a.m. and 8 p.m. Monday through Friday, 9 a.m. and 8 p.m. on Saturday, except Sundays and holidays, when the exemption herein shall apply between 10 a.m. and 6 p.m.

(b) [C]onstruction, alteration and repair activities, which are authorized by valid city permit shall be allowed between the hours of 8 a.m. and 8 p.m. Monday through Friday, 9 a.m. and 8 p.m. on Saturday, and 10 a.m. and 6 p.m. on Sundays and holidays, if they meet at least one of the following standards: (1) No individual piece of equipment shall produce a noise level exceeding 110 dBA at a distance of 25 feet. If the device is housed within a structure on the property, the measurement shall be made outside the structure at a distance as close to 25 feet from the equipment as possible. (2) The noise level at any point outside of the property plane of the project shall not exceed 110 dBA. Posting notice of construction hours is required … for the purpose of informing all contractors and subcontractors … of the basic requirements of this chapter.

Table XI-1 shows typical noise levels of construction equipment at a distance of 25 feet. As is shown from the typical noise levels, no individual piece of equipment is expected to exceed 110 dBA at a distance of 25 feet.

Table 4. Typical Noise Levels of Construction Equipment

Equipment	Noise Levels at 25 Feet (dB)
Backhoes/Grade-all	78-99
Loaders	78-90
Dump Trucks	89-100
Cement Trucks	89-100
Chain Saws	90-100
Pavement Breakers	82-92
Jackhammers	88-103
Pile Drivers	100-110
Pumps*	75-77
Generators*	77-89

Source: Santa Clara Valley Water District, Matadero/Barron Creeks Remediation Project, Screen Check DEIR, August 2001.
*Source: USEPA, 1971, 50 foot estimates (dB) + 6 dB for distance halving.

Construction equipment to be used at the floodwall replacement site, in residential areas of East Palo Alto and Palo Alto, includes dump trucks, pumps, generators, excavators, concrete trucks, backhoes, bulldozers and support vehicles (such as trailers and pick-up trucks).

Construction Best Management Practices shall apply to the proposed project at both the floodwall replacement site and the levee restoration site. These BMPs are outlined below, in section (d). The project, provided it follows these guidelines, will conform to the City of Palo Alto Noise Ordinance.

City of East Palo Alto General Plan Noise Element

The East Palo Alto Noise Element is primarily a land use document which addresses land use compatibilities based on existing local noise levels, includes standards for noise levels in new buildings, and addresses other local sources of noise, including traffic. It does not contain policies that address temporary construction noise. Because the only noise impacts expected from the proposed project are temporary construction-related impacts, the East Palo Alto Noise Element does not contain any standards that may be exceeded as a result of the project.

City of East Palo Alto Noise Ordinance

The City of East Palo Alto has not yet adopted a Noise Ordinance. Thus no discussion of the proposed project's adherence to a Noise Ordinance from the City of East Palo Alto can be completed.

b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

Less Than Significant Impact. At the floodwall replacement site, the project consists of the removal of the existing floodwall, its replacement with a new higher floodwall, and the addition of sacked concrete to the existing floodwall for some distance upstream of the new floodwall. None of these project components are expected to use equipment that will cause excessive groundborne vibration or noise levels. Much of the equipment for the project is proposed to be used from the bed of San Francisquito Creek, which will further reduce vibration and noise impacts to residents near the floodwall replacement site.

At the levee restoration site, the project consists of adding dirt in a contained and packed fashion to the top of the existing levees. As at the floodwall replacement site, the equipment used at this site is not expected to create excessive groundborne vibrations or noise. The equipment will include standard construction equipment. Groundborne vibrations or noise may be felt near the project, but are not expected to be significant. The temporary nature of the noise effects at both sites also results in less than significant impacts.

c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

No Impact. The proposed project would not result in a permanent generation of any noise. Consequently no noise standards governing permanent noise sources, established in the Palo Alto or East Palo Alto General Plans, will be exceeded as a result of the project. Raising the levees and floodwalls along either proposed portion of San Francisquito Creek will not alter the noise environment through changes in either land use or transportation, because the project will not alter any land uses or permanently alter traffic. In addition, the proposed project will not result in an increased exposure of residents or recreationists to existing noise sources, which include neighborhood and freeway traffic, the Palo Alto Airport, and adjacent residences. The project may result in slightly increased noise protection to residents in Palo

Alto along the floodwall replacement portion of the project, and to residents in East Palo Alto along the levee restoration portion of the project.

Along the proposed levee portion of the project reach, the top of the levee is currently even with or above the height of residences in East Palo Alto neighborhoods. Because the levee lies between the Palo Alto Airport and East Palo Alto residences, it serves as a barrier to ground-level noise from the airport. The sound protection afforded to some East Palo Alto residents from the noise associated with the airport will not be changed by the project.

Behind residences within the City of Palo Alto along the floodwall replacement portion of the project, the existing floodwall will be replaced along a stretch from 0 to 1000 feet upstream of the Highway 101/San Francisquito Creek bridge by a new wall up to two feet higher. This increase in height will not result in the exposure of residents to increased noise levels.

d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

Less Than Significant Impact With Mitigation Incorporation. Project construction will result in a temporary increase in ambient noise levels in the project vicinity, at both the floodwall replacement site and the levee restoration site. Although noise levels associated with construction at both sites will not exceed standards in applicable Noise Ordinances or General Plans, they may be perceived as disruptive in residential areas along the creek in East Palo Alto and Palo Alto.

Construction noise from the levee restoration site will be audible at East Palo Alto residences and the Palo Alto Golf Course. However, the noise impacts associated with construction will not be substantial or significantly greater than impacts associated with most construction projects. Golfers and other recreational users are not considered sensitive receptors because exposure is voluntary and of short duration.

At both the floodwall replacement and levee restoration sites, construction noise will be distinct and audible, but individual residences along the creek will be exposed to maximum noise levels for only a portion of the total project, as the construction work moves along the creek.

The following mitigation measure will ensure that significant effects are either reduced or avoided:

Mitigation NOI-1: Minimize Disturbances to Surrounding Neighborhoods. The City of East Palo Alto and SCVWD shall implement the following practices to minimize disturbances to neighborhoods surrounding work sites.

1. Work shall be conducted in accordance with the City of East Palo Alto and Palo Alto Noise Ordinances.
2. Internal combustion engines shall be equipped with adequate mufflers so that no hourly noise levels above 85 dBA Leq are produced at 100 feet from the source.
3. Excessive idling of vehicles will be prohibited.
4. Levee traffic shall be limited to a speed of 15 miles per hour.

Implementation:	City of East Palo Alto and SCVWD
Timing:	During construction phase
Fiscal responsibility:	JPA Member Agencies
Monitoring:	San Mateo County Department of Public Works

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

No Impact. The levee portion of the project site is located within one-half mile of the Palo Alto Airport. The airport does not provide commercial air service. The project will not result in new development or the placement of new residents near the airport, nor will it alter the surroundings so as to expose nearby residents to any additional noise. Thus, the project will not modify the existing noise impacts of the airport. The number of construction workers at the levee site will be limited to approximately 20 for a short-term duration (3-5 months), and workers would not be subject to significant noise hazards associated with the proximity of this airport.

f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

No Impact. The project is not within the vicinity of a private airstrip.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
XII. POPULATION AND HOUSING – Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

Discussion:

Would the project:

a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?

No Impact. The proposed project consists of short-term construction work on existing creek levees. The project will not result in new residential development or population growth and does not require the relocation of work staff to the community that could result in population increases.

b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere; or,

c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?

No Impact. The proposed levee restoration will occur on existing levees and will not result in removal of housing or other structures or displacement of people.

XIII. PUBLIC SERVICES --

a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
i) Fire protection?	☐	☐	☐	☒
ii) Police protection?	☐	☐	☐	☒
iii) Schools?	☐	☐	☐	☒
iv) Parks?	☐	☐	☐	☒
v) Other public facilities?	☐	☐	☐	☒

Discussion:

Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities or need for new or physical altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:

a) Fire protection; b) Police protection; c) Schools; d) Parks; or, e) Other public facilities?

No Impact. The proposed project consists of restoring existing creek channel levees to their original as-built condition as part of flood control activities. The temporary construction activities and associated work crews will not have an impact on fire or police protection services. The project does not involve new permanent construction and will bring no new students to the area, require no new school facilities, or impact parks/recreation facilities or other governmental services. There is no impact from the project to the public services listed above.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
XIV. RECREATION --				
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☒	☐
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒

Discussion:

Would the project:

a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

Less Than Significant Impact. The proposed project consists of restoring the height of an existing levee for flood control, and will not result in development that would increase or alter the population of the area or lead to an increase in the use of recreational facilities.

The project will result in temporary closure of the levees on both sides of the creek, which are used as a recreational pedestrian and bicycle path. Approximately one half mile of the levee pathway on the Santa Clara County side of the creek is part of a regional trail system within the City of Palo Alto. The levee is paved between Geng Road and the downstream end of the project at the existing pedestrian bridge. This portion of the levee provides a commuter bicycle connection between paved roadways in Palo Alto to trails in East Palo with the pedestrian bridge at the downstream end of the project serving as the connector. This portion of the levee also provides a recreational trail connection to unpaved trails within the adjacent Palo Alto Baylands Nature Preserve (see Figure 5). The 1,940-acre Baylands Nature Preserve provides 15 miles of multi-use trails, of which the 1±-mile project segment is a part. The levee pathway is a currently designated pedestrian path and bicycle path in the City of Palo Alto Comprehensive Plan (Maps T-5 and T-6).

The dirt levee on the San Mateo County side of the creek is located within the city of East Palo Alto and also serves as a pedestrian and bicycle path. The path is not an officially designated trail within the city, but is used by pedestrians and bicyclists (Bassman, personal communication, February 2001).

Project construction will result in the temporary closure of the levees during the 3-5 month construction period. Given the nature of the construction—adding soil to restore the height of the levee elevations to their original condition—it is not possible to close only sections of the levee at one time and maintain partial access. The temporary construction is not considered significant due to the fact that it will be temporary, short-term (3-5 months). The City of Palo Alto's Moonlight Run is scheduled on September 20. The contractor shall work with the City of Palo Alto to coordinate the construction schedule to ensure safety and access for this event.

In order to minimize disturbance to users, signs will be posted at the downstream and upstream pedestrian bridge locations in advance of construction to warn users of the temporary closure. The closure will also be discussed at a pre-construction public meeting. Alternate routes will be identified and posted, where available. The pathway will be repaved as part of the project. Therefore, this short-term and temporary closure is not considered significant.

The floodwall portion of the proposed project does not contain trails or continuous access along the top of the creek channel. This is true for both the East Palo Alto and Palo Alto sides of the creek. Thus, floodwall demolition and construction will not cause any adverse effects to recreation values in the project area.

b) Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?

No Impact. The area of the proposed project does have a recreational trail on the Palo Alto side of the levee (see above discussion). The proposed project will not require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment.

	Potentially Significant Impact	**Less Than Significant with Mitigation Incorporation**	**Less Than Significant Impact**	**No Impact**
XV. TRANSPORTATION/TRAFFIC -- Would the project:				
a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?	☐	☐	☒	☐
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?	☐	☐	☒	☐
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☒	☐	☐
e) Result in inadequate emergency access?	☐	☐	☐	☒
f) Result in inadequate parking capacity?	☐	☐	☒	☐
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	☐	☐	☒	☐

Discussion:

Would the project:

a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (for example, result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections); or,

b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?

Less Than Significant Impact. The proposed project will result in minor traffic increases associated with workers traveling to and from the worksite over the duration of construction period as well as trucks going to and from sites to bring in the imported fill material. It is estimated that project activities will result in approximately 60 trips per day, based on an estimated total of 20 workers, 20 round-trip truck trips per day to bring imported fill and equipment to the site. The floodwall will add only a total of 35 to 45 truckloads over ten working days (2 weeks) or about 4 –5 per day during that time.

Workers and materials will be delivered to the construction staging areas on either side of the creek. These areas are planned at the end of Geng Road in Palo Alto at the Baylands Athletic Center and at the end of O'Connor Road in East Palo Alto.

The project will result in limited increases in traffic on vicinity roads for the 3 to 5 month construction period. Access will be provided via the major roadways in the project vicinity, and truck routes may be established by the cities of Palo Alto and East Palo Alto. The majority of the truck trips will be during off-peak hours. Project traffic of approximately 60 trips per day will not result in significant traffic increases on local streets in relation to existing traffic volumes. Given the temporary and short-term duration of the activities, increased traffic is not considered significant. The project does not require any changes to roadway design or permanently generate increased vehicle trips or traffic congestion.

c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location, that results in substantial safety risks?

No Impact. The proposed Levee Restoration and Floodwall Demolition and Reconstruction project will not result in a change in air traffic patterns.

d) Substantially increase hazards due to a design feature (for example, sharp curves or dangerous intersections) or incompatible uses (for example, farm equipment)?

Less Than Significant Impact With Mitigation Incorporation.

The proposed project does not require any changes to roadway or intersection design or result in incompatible uses. However, the construction phase of the project will add large equipment and associated vehicles onto urban roadways that may not be compatible with existing vehicular and pedestrian uses. Implementation of the following mitigation measure will reduce or avoid traffic and traffic safety impacts:

MITIGATION TRAF-1: The City of East Palo Alto and SCVWD shall implement the following public safety measures during maintenance:

1. Construction signs shall be posted at job sites warning the public of construction work and to exercise caution.
2. When necessary, a person shall be provided for traffic control.
3. If needed, a lane shall be blocked off to allow for trucks to pull into and out of the access points.
4. Where work is proposed adjacent to the recreational trail, warning signs shall be posted several feet beyond the limits of work.

Implementation:	City of East Palo Alto and SCVWD
Timing:	During construction phase
Fiscal responsibility:	JPA Member Agencies
Monitoring:	San Mateo County Department of Public Works

e) Result in inadequate emergency access?

No Impact. The proposed raising of existing levee elevations and demolition and reconstruction of the floodwalls are temporary construction activities. Work activities will take place on the tops of the levees, creek channel and the tops of the channel and within designated staging areas. The project will not result in new development that would require emergency access.

f) Result in inadequate parking capacity; or,

g) Conflict with adopted policies, plans, or programs supporting alternative transportation (for example, bus turnouts, bicycle racks)?

Less Than Significant Impact. Parking of vehicles (usually a few SCVWD vehicles and possibly a few private automobiles) during the day would occur at the staging areas, where parking is available, especially on the east side of the creek at the Baylands Athletic Center parking lot. SCVWD will coordinate with the City of Palo Alto on the placement of the staging area as to the use of the Athletic Center Parking Lot. Heavy equipment, such as excavators can be left at the staging area site during the duration of the activity but not on a public street. The project is temporary in nature and would not generate a long-term or permanent demand for existing or new parking. No private vehicles of construction workers would park on West Bayshore Road during the duration of the construction process. They will park in the staging areas and will be shuttled with contractor's vehicles. No more than 5 vehicles at one time will park at the West Bayshore Road/San Francisquito Creek area.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
XVI. UTILITIES AND SERVICE SYSTEMS – Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☒
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☒
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☒	☐
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☒	☐

Discussion:

Would the project:

a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board;
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause

significant environmental effects;

c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects;

d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed; or

e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's demand in addition to the provider's existing commitments?

No Impact. The project consists of construction activities that do not result in the need for new utility systems, supplies or alterations to the aforementioned utilities because they do not result in population growth.

f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs; or,

g) Comply with federal, state, and local statutes and regulations related to solid waste?

Less Than Significant Impact. The project will result in importation of materials for restoring the height of the existing levees. There will be minimal disposal of construction-related materials, and these will be properly disposed of by the contractor.

For the floodwall work, it is anticipated that the inert demolition debris will be taken to a recycle center in Redwood City. It is anticipated that there will be approximately 50 cubic yards of inert debris to recycle on the City of East Palo Alto side. This would be approximately 5 semi end dump loads and could be done within a few days. On the City of Palo Alto side of the creek, it is anticipated that there will be approximately 350-400 cubic yards of inert debris. This would be 35-40 truckloads spread out over 2-3 weeks.

For both sides of the creek and for all sites, the preferred truck route would be West or East Bayshore to Embarcadero Ave. to Hwy 101. Disposal will not result in the need for new landfills or alter the current waste system. The SCVWD and the City of East Palo Alto comply with all statutes and regulations pertaining to solid waste.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
XVII. MANDATORY FINDINGS OF SIGNIFICANCE --				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☒	☐	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☐	☐	☒	☐
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☒	☐

Discussion:

a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?

Less Than Significant Impact with Mitigation Incorporation. See Biology subsection above regarding special status species. The project has been designed to protect mature vegetation and trees, and sensitive wetland habitat areas through use of reinforced earth at the edge of the levee and with the incorporation of the planned BMPs. These low-height features will prevent encroachment onto the slopes and protect sensitive vegetation in the area. There will be no work conducted within the San Francisquito Creek channels and no impacts to fish populations. Best Management Practices (BMPs) are incorporated into the project avoid and minimize significant impacts to wildlife species. The project does not affect any cultural resources. Thus, the project will have less-than-significant impacts to the aforementioned environmental factors.

b) Have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of the past projects, the effects of other current projects, and the effects of probable future projects.)

Less Than Significant Impact. The project consists of restoring the height of existing levee elevations along an approximately one-mile segment of San Francisquito Creek. The construction will occur over a 3 to 5-month period, and would result in temporary construction-related impacts. There will be no permanent removal or loss of habitat. There are no known significant cumulative impacts to which the project would contribute.

c) Have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?

Less Than Significant Impact. As evaluated in this Initial Study, the proposed project would either have no impact or less-than-significant impacts on human beings, either directly or indirectly. Short-term construction-related impacts will be minimized or avoided with implementation of the Mitigation Measures incorporated into the Project (Section 2.3) and the Mitigation Measures that will be applied as a result of this project (Section 3)

3.5 DETERMINATION:

On the basis of this initial evaluation:

I find that the proposed Project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.	
I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.	X
I find that the proposed project MAY have a significant effect on the environment and an ENVIRONMENTAL IMPACT REPORT is required.	
I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect (1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and (2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.	
I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.	

Walt Callahan, Flood Control Utilities Manager,
San Mateo County Flood Control District

Date

SECTION 4. MITIGATION MONITORING and REPORTING PLAN

The purpose of this Mitigation Monitoring and Reporting Program (MMRP) is to verify implementation of the mitigation measures identified in the San Francisquito Creek Levee Restoration and Floodwall Reconstruction Initial Study/Mitigated Negative Declaration in compliance with the California Environmental Quality Act Guidelines §15097.

The project objective is to increase flood flow capacity within San Francisquito Creek by restoring the levees downstream of Highway 101 to their as-built 1958 elevation, and by rebuilding an 1100 foot section of floodwall in Palo Alto and closing a weir and "CALTRANS gap" on the East Palo Alto side upstream of Highway 101. The city of Palo Alto's bike path on top of the levee will also be removed and rebuilt in the process.

The analysis contained in Section 3 of this document identifies significant environmental impacts, all of which can be mitigated to less than significant levels by measures also contained in this document. Many of these impacts could be avoided or minimized by the implementation of Best Management Practices (BMPs) as listed in Section 2.3 of this document. These measures are listed below in Table MMRP-1.

Section 3 of this document also found that potentially significant impacts from the project's construction activities could occur in the following major categories: aesthetics, biological resources, cultural resources, hazards and hazardous materials, hydrology, noise and transportation and traffic. Table MMRP-2 summarizes the potentially significant effects of the project and incorporated mitigation measures.

The origin of many of the BMPs and mitigation measures contained in this document is the Santa Clara Valley Water District's Stream Maintenance Program EIR (2001). These measures have been modified to the specific conditions at the project site.

II. BEST MANAGEMENT PRACTICES

BMPs are methods that protect environmental quality or reduce environmental impacts from stream maintenance activities. BMPs are most often implemented at the time work on an individual routine maintenance activity is conducted in the field, however, they also can be implemented at the time of planning or design. Table MMRP-1 lists the specific BMPs that will be utilized to avoid, minimize or mitigate for potentially significant impacts of the Project. The responsibilities listed in this BMP Table are as follows: **Implementation and Timing** refers to when the actual BMP will be applied. **Fiscal Responsibility** lists what entity (or entities) that will be responsible for ensuring that this BMP gets implemented. It does not mean that these entities are responsible for paying for each BMP, but part of the responsibility is to ensure that there are funds to implement the BMP. **Monitoring Responsibility** lists who is ultimately responsible for ensuring that this BMP was applied in the correct manner.

III. MITIGATION PROGRAM TO REDUCE IMPACTS OF THE PROJECT

The mitigation actions required of the project proponent (City of East Palo Alto, SCVWD) and the Lead Agency (District) are defined in Section 3 of this document and are presented together in Table MMRP-2 of this Chapter. These mitigation measures will avoid or reduce all significant effects to less than significant levels. CEQA Guidelines Section 15091 (d) further requires the mitigation measures being monitored or the subject of reporting must be "fully enforceable through permit conditions, agreements, or other measures". Thus, Table MMRP-2 lists the same responsibilities as listed above. The District will be responsible for the reporting mechanism that will be put into place to follow the various mitigation actions so that the MMRP can be tracked and evaluated for compliance. Reports should be completed on a weekly basis for those mitigation measure that require reporting, Table MMRP-2 will list those measures that need reporting. Reports shall include the following:

- Inspector's name
- Location of the inspection activities
- A description of the activity or mitigation that was inspected
- An assessment of whether or not the activity was in compliance with the MMRP
- Any actions or communications that took place in the field to bring the activity back into compliance with the MMRP, and
- Any follow-up actions or communications that may be required.

This report shall be completed within a month after completion of the construction phase of the Project, and shall be submitted to the County's Board of Supervisors upon completion. It should also be on file in the District's office.

Table MMRP-1
Best Management Practices (BMPs)

BMP #	BMP Name and Description	Implementation and Timing	Fiscal Responsibility	Monitoring Responsibility
1.	All work will be performed between June 15 to October 15.	--	--	District, JPA, SCVWD
2.	The contractor will implement the following maintenance practices that minimize disturbances to neighborhoods surrounding work sites: • Internal combustion engines shall be equipped with adequate mufflers. • Excessive idling of vehicles will be prohibited. • Levee traffic shall be limited to a speed of 15 miles per hour. • Dry sediment shall be wetted down or covered as needed to control dust during transport.	During construction phase	Contractor, SCVWD and City of East Palo Alto	San Mateo County Department of Public Works
3.	The contractor shall implement measures to minimize soil from being tracked onto streets near work sites. Methods used to prevent mud from being tracked out of work sites onto roadways include installing a layer of geotextile mat, followed by a 4-inch thick layer of 1-3- inch diameter gravel on unsurfaced access roads.	During construction phase	Contractor, SCVWD and City of East Palo Alto	San Mateo County Department of Public Works
4.	If possible, all work will be conducted during normal working hours, Mondays through Fridays. In and adjacent to residential areas, no construction will occur between the hours of 6:00 PM and 8:00 AM, unless otherwise permitted or restricted by local ordinances.	During construction phase	--	San Mateo County Department of Public Works
5.	To protect pedestrians, bicyclists and other recreational users, the Contractor shall post signs warning of the construction and truck traffic several hundred feet beyond the limits of work and shall post signs at least one month in advance of construction to alert trail users to temporary path closures. Orange safety fencing or chain link fencing shall be installed around the construction area as needed. Temporary detours may be created, where available, to minimize conflicts with recreational users on the levee trail on the Palo Alto side of the creek.	During construction phase	Contractor	San Mateo County Department of Public Works
6.	Pumps and generators will be maintained and operated in a manner that minimizes impacts to water quality and aquatic species.	During construction phase	Contractor	San Mateo County Department of Public Works
7.	Pumps and generators will be maintained according to manufacturers' specifications to regulate flows to prevent dryback or washout conditions.	During construction phase	Contractor, SCVWD and City of East Palo Alto	San Mateo County Department of Public Works

BMP #	BMP Name and Description	Implementation and Timing	Fiscal Responsibility	Monitoring Responsibility
8.	Pumps will be operated and monitored to prevent low water conditions, which could pump muddy bottom water, or high water conditions, which creates ponding.	During construction phase	Contractor, SCVWD and City of East Palo Alto	San Mateo County Department of Public Works
9.	Pump intakes will be screened to prevent uptake of fish and other vertebrates.	During construction phase	Contractor, SCVWD and City of East Palo Alto	San Mateo County Department of Public Works
10.	If soil is to be stockpiled, no run-off will be allowed to flow back to creek.	During construction phase	Contractor, SCVWD and City of East Palo Alto	San Mateo County Department of Public Works
11.	During construction, the amount of soil exposed at one time will be minimized. The project will be scheduled sot that only portions of the site are disturbed at one time. Grading will proceed as expeditiously as possible. Disturbed areas will be stabilized as soon as possible before grading the next portion.	During construction phase	--	San Mateo County Department of Public Works
12.	Upon completion of grading in any given area, the soil surface will be protected. One or combination of the following measures will supply immediate protection: • A minimum three inch application of blown straw or mulch product, • installation of an erosion control blanket or hydroseeding/hydromulching with and erosion control seed mix composed of species that are consistent and compatible with surrounding vegetation. Mulch can be ground-up woody products and/or leaves from either native material or from soil suppliers. No non-native material that has alleopathic compounds (Eucalyptus spp.) will be used.	During construction phase and immediately after construction	Contractor, SCVWD and City of East Palo Alto	San Mateo County Department of Public Works
13.	Equipment storage and maintenance sites will be located outside of the channel area, and trees or other vegetated areas will not park equipment in order to avoid soil compaction. Staging and storage areas will be properly fenced and lighted for security. Secondary containment will be provided for chemical storage to ensure adequate containment in the event of spills or leaks	During construction phase and immediately after construction	Contractor, SCVWD and City of East Palo Alto	San Mateo County Department of Public Works
14.	To reduce sediment tracking offsite, construction entrance(s) will be stabilized with an aggregate or gravel pad. Staging areas, parking areas and other non-paved areas will be similarly protected with gravel, aggregate or other surface protection measures, where appropriate, to prevent offsite tracking of sediment.	During construction phase	Contractor, SCVWD and City of East Palo Alto	San Mateo County Department of Public Works
15.	Bay Area Air Quality Management District (BAAQMD) Basic Control Measures for reducing air quality impacts will be	During construction phase	Contractor, SCVWD and City of East Palo Alto	San Mateo County Department of

BMP #	BMP Name and Description	Implementation and Timing	Fiscal Responsibility	Monitoring Responsibility
	implemented at all staging areas and worksites. Current measures stipulated by the BAAQMD CEQA Guidelines include the following: • Active maintenance areas will be watered at least twice per day unless soils are already sufficiently moist to avoid dust. • Trucks hauling sediments and other loose material will be covered or shall maintain at least two feet of freeboard. • Tailgates of trucks will be sealed. • Trucks will be brushed down before leaving the maintenance site. • Unpaved access roads and staging areas that are being used for the maintenance activity will be watered three times daily, or non-toxic soil stabilizers will be applied to control dust generation.			Public Works
16.	Paved maintenance site access roads will be swept when visible soil material is carried into the roadway.	During construction phase	Contractor, SCVWD and City of East Palo Alto	San Mateo County Department of Public Works
17.	All construction equipment will be equipped with manufacturer's standard noise control devices; internal combustion engines will be equipped with adequate mufflers. Excessive idling of vehicles will be prohibited.	During construction phase	Contractor, SCVWD and City of East Palo Alto	San Mateo County Department of Public Works

Table MMRP-2
Project Mitigation Measures

Mitigation Measure Name and Description	Implementation and Timing	Fiscal Responsibility	Monitoring Responsibility
Mitigation measure AES-1: Temporary security lighting at the construction staging areas shall have motion sensors so that the lights do not stay on all night. All new light fixtures shall have glare guards to direct the light beams downward and to shield surrounding areas from additional light or glare.	District, through SCVWD Timing: Construction phase	JPA Member Agencies	San Mateo District Department of Public Works
Mitigation measure BIO-1: Within 30 days of construction start date, a qualified biologist (familiar with the sensitive species that could be present at the San Francisquito Creek project sites) shall survey for sensitive animals, plants and communities in areas where the compacted earth method of levee raising shall be used. For the annual plant species listed in this section, a qualified botanist familiar with the sensitive species shall survey for these sensitive plants during their flowering season. In the event that a sensitive animal, plant or community is found, the alternative construction method of reinforced earth shall be used. All sensitive animals, plants and communities and their buffer zones shall be surrounded by orange safety fencing. The buffer zone width may vary depending on the location, type of plant/community and type of construction work in the area, and shall be determined by the biologist.	District, through SCVWD Timing: No more than 30 days prior to construction except for the annual plants, flowering times are listed in this section.	JPA Member Agencies	San Mateo District Department of Public Works
Mitigation Measure BIO-2: In order not to impede upland habitat usage, construction activities shall be suspended in areas adjacent to pickleweed habitat when water levels in the channel inundate 50% of the pickleweed habitat (Padley, SCVWD). The level of 50% inundation shall be established in the field by a qualified biologist in collaboration with SCVWD and shall be marked clearly in the field so that recognition is obvious. Construction workers will be briefed by a qualified biologist on the presence of the salt marsh harvest mouse and how to recognize 50% pickleweed inundation during high tide events.	District, through SCVWD Timing: The inundation levels shall be marked within 30 days prior to start of work, and then pre-construction briefings with the contractor shall be performed at start of work.	JPA Member Agencies	San Mateo District Department of Public Works
Mitigation Measure BIO-3: The Levee Restoration project site shall be checked by biologists for nesting birds in conformance with the USFWS formal Clapper Rail protocol no more than 30 days prior to starting levee restoration activities. In areas where nesting	District, through SCVWD Timing: No more than 30 days prior to start of work.	JPA Member Agencies	San Mateo County Department of Public Works

Mitigation Measure Name and Description	Implementation and Timing	Fiscal Responsibility	Monitoring Responsibility
birds are found or are likely to occur, the construction period will be modified so that work is not done during active nesting in the area and/or appropriate buffers have been established in consultation with a qualified biologist and USFWS.			
Mitigation Measure BIO-4: To avoid potential impacts to burrowing owls from construction activities, the following measures shall apply: 1. Preconstruction surveys shall be conducted by a qualified biologist prior to any soil-altering or other pre-construction activities. The preconstruction surveys shall be conducted per CDFG guidelines. Any and all surveys shall be performed no more than 30 days prior to the start of soil disturbance in any given project segment. If no burrowing owls are found, then no further mitigation would be needed. If burrowing owls are found, then further mitigation shall be implemented, as follows: If breeding owls are located on or immediately adjacent to proposed construction areas, a construction-free buffer zone must be established around the active burrow(s) as determined by the biologist in consultation with CDFG. No activities, including grading or evictions of owls, should proceed that may disturb breeding owls. Construction in those buffer areas should take place outside of the breeding season (February 1 through August 31, with peak period April and May) or after the biologist has determined that all breeding activity has concluded for the season and any young have fledged. If burrows occupied by owls are found and the burrows could be physically impacted by proposed improvements, then mitigation measure (2) shall also be implemented. 2. The project should be redesigned to avoid direct impacts to occupied burrows. Avoidance is the preferred mitigation approach. If the project cannot be redesigned to avoid occupied burrows, then the owls could be evicted from the site. Owls shall only be evicted outside of the February 1 through August 31 breeding season. Evictions shall only be implemented by a qualified biologist in consultation with CDFG. The proposed project would permanently impact at most only a very small amount of potential burrowing owl	District, through SCVWD Timing: No more than 30 days prior to start of work.	JPA Member Agencies	San Mateo County Department of Public Works

Mitigation Measure Name and Description	**Implementation and Timing**	**Fiscal Responsibility**	**Monitoring Responsibility**
habitat and does not propose management measures that would preclude colonization by ground squirrels or burrowing owls. These avoidance measures would thus be adequate to reduce the impact to a less-than-significant level. Additional mitigation may be required by CDFG, however, as a condition for permitting eviction.			
Mitigation Measure BIO-5: Salvage native aquatic vertebrates from dewatered portions of the creek. If fisheries or native aquatic vertebrates are present when the cofferdams for the floodwall portion of the project are to be installed, a steelhead and native aquatic vertebrate relocation plan will be implemented by a qualified biologist to ensure that fish and native aquatic vertebrates are not stranded. The biologist shall be present during the installation of the cofferdam and the creek dewatering process. Moving animals will be consistent with applicable USFWS and California Department of Fish and Game (CDFG) permits. Invasive non-native species will not be transferred due to their harm to the aquatic ecosystem. Native aquatic invertebrates similarly will not be transferred, but are expected to be abundant and will recolonize the site after completion of the repair work	District Timing: Throughout construction phase	JPA Member Agencies	San Mateo County Department of Public Works
Mitigation Measure BIO-6: Restore Configuration of Channel Bottom. The contractors shall re-grade all portions of the channel bottom at the end of the work project to be as close to pre-construction conditions as possible. The depth and size of the low flow channel shall emulate the pre-construction conditions as closely as possible within the finished channel topography. Temporary fills, such as for access ramps, diversion structures, or cofferdams, shall be completely removed upon finishing the work. As part of this mitigation measure, a qualified biologist shall provide adequate photo documentation of the sites before, during and after construction. Creekbed restoration work shall be approved by the District prior to project initiation to ensure that the contractor is aware of the existing condition of the site, so that the City of East Palo Alto, SCVWD and the contractor can know what condition the site shall be returned to upon project completion. Determination of adequacy of the	District Timing: Throughout construction phase	JPA Member Agencies	San Mateo County Department of Public Works

Mitigation Measure Name and Description	Implementation and Timing	Fiscal Responsibility	Monitoring Responsibility
photos for this measure shall be determined by a representative of the County's Environmental Services Division.			
Mitigation Measure BIO-7: Erosion and sediment control measures to avoid the flow of sediment into sensitive pickleweed salt marsh community. Sediment retention measures such as silt fencing, straw bales, and straw or coir wattles shall be installed on the side of the levee that has pickleweed salt marsh community for the entire length of the project, to prevent any loose material from falling or sliding into the creek during the construction process. Sediment retention measures, most likely silt fencing in this case, shall also be installed on the outboard side of the levee slopes where use of reinforced earth is planned. All sediment retention measures installed shall be maintained in accordance with the manufacturer's recommendations and/or with the installation and maintenance recommendations provided in the California Storm Water BMP Handbook. Proper removal and disposal of collected sediments and fencing shall be achieved upon completion of project construction. Water will not be allowed to drain directly into the creek channels.	District Timing: Throughout construction phase, whenever applicable	JPA Member Agencies	San Mateo County Department of Public Works
Measure BIO-8: The contractor shall use equipment that minimizes disturbance to the stream bottom. Appropriately-tired vehicles, either tracked or wheeled, shall be used depending on the situation.	District Timing: Throughout construction phase, whenever applicable	JPA Member Agencies	San Mateo County Department of Public Works
Mitigation Measure BIO-9: Avoid impacts to native tree species. Removal of existing native trees shall be prohibited unless the tree is demonstrated to be unhealthy, diseased or unsafe by a qualified arborist, or is less than 11.5 inches in diameter. Oaks and other native trees to be retained that are located in or near the planned construction area must be fenced in order to protect them against inadvertent damage during grading and construction. The dripline of oak trees shall be entirely fenced.	District Timing: Throughout construction phase, whenever applicable	JPA Member Agencies	San Mateo County Department of Public Works
Mitigation Measure BIO-10: Project construction could cause the loss of active bird nests or young. To avoid impacts to breeding birds (including raptors and migratory birds), preconstruction surveys shall be conducted and avoidance measures shall be implemented if necessary. No project activities that could cause nest abandonment shall occur prior to the surveys. A qualified biologist shall conduct the survey no more than 30 days prior to the initiation of project	District Timing: No more than 30 days prior to start of work.	JPA Member Agencies	San Mateo County Department of Public Works

Mitigation Measure Name and Description	Implementation and Timing	Fiscal Responsibility	Monitoring Responsibility
construction. If nesting activity is discovered, the biologist shall determine the extent of a construction free buffer zone (typically 250 feet) to be established around the nest. No disturbance that could cause nest abandonment would occur within that buffer zone until the biologist has determined that all breeding activity has concluded for the season and young (if any) have fledged.			
MITIGATION CUL-1: Discovery of Cultural Remains or Historic Artifacts Work in areas where remains or artifacts are found will be restricted or stopped until proper protocols are met. 1. Work at the location of the find will halt immediately within 30 feet of the find. If an archaeologist is not present at the time of the discovery, either SCVWD or the City of East Palo Alto (depending on the location) will contact an archaeologist for identification and CEQA evaluation. 2. If the find is not significant, construction can continue. The archaeologist will prepare a brief informal memo/letter that describes and assesses the significance of the resource, including a discussion of the methods used to determine significance for the find. 3. If the find appears significant, the archaeologist will determine if the resource can be avoided and will detail avoidance procedures. 4. If the resource cannot be avoided, the archaeologist will develop within 48 hours an Action Plan to avoid or minimize impacts. The contractor will not proceed until the Action Plan is approved by the City of East Palo Alto or SCVWD. 5. The recovery effort will be detailed in a report prepared by the archaeologist in accordance with current archaeological standards. Any non-grave artifacts will be placed with an appropriate repository. 6. In the event of discovery of human remains, the field crew supervisor shall take immediate steps to secure and protect such remains. 7. The Santa Clara County Coroner or San Mateo County Coroner shall be notified and informed of the find and of any efforts made to identify the remains as Native American. If the remains are determined to be from a prehistoric Native American, the medical examiner is responsible for contacting the	District Timing: Throughout construction phase, whenever applicable	JPA Member Agencies	San Mateo County Department of Public Works

Mitigation Measure Name and Description	Implementation and Timing	Fiscal Responsibility	Monitoring Responsibility
Native American Heritage Commission (NAHC) within 24 hours of notification. The NAHC then designates and notifies within 24 hours a Most Likely Descendant (MLD). The MLD has 24 hours to consult and provide recommendations for the treatment or disposition, with proper dignity, of the human remains and grave goods. 8. Preservation in situ is the preferred option, and if the SCVWD and the City of East Palo Alto can do this without incurring potential future disturbance, then the MLD will usually recommend no further action. The remains and artifacts will be documented and the find location carefully backfilled to avoid further disturbance. Human remains or cultural items exposed during maintenance that are subject to further disturbance will be exhumed archaeologically at the discretion of the MLD and reburied with the concurrence of the MLD in a place mutually agreed upon by all parties.			
MITIGATION HAZ-1: The SCVWD and the City of East Palo Alto shall prevent the accidental release of chemicals, fuels, lubricants, and non-storm drainage water into San Francisquito Creek during project construction. • SCVWD field personnel will be appropriately trained in spill prevention, hazardous material control, and clean-up of accidental spills. • No fueling, repair, cleaning, maintenance, or vehicle washing shall be performed in the creek channel or in areas at the top of the channel bank that may flow into the creek channel. Spill prevention kits shall always be in close proximity when using hazardous materials (e.g., crew trucks and other logical locations).	City of East Palo Alto and SCVWD Timing: Throughout construction phase	JPA Member Agencies	San Mateo County Department of Public Works
MITIGATION HAZ-2: No fueling shall be done in the San Francisquito stream channel or immediate floodplain, unless equipment stationed in these locations is not readily relocated i.e., pumps, generators. For stationary equipment that must be fueled on site, such as the pumps for the floodwall construction, containment will be provided in such a manner that any accidental spill of fuel will not be able to enter the water or contaminate sediments that may come in contact with water. Any equipment that is readily moved out of the channel will not be fueled in the channel or immediate floodplain.	City of East Palo Alto and SCVWD Timing: Throughout construction phase	JPA Member Agencies	San Mateo County Department of Public Works

Mitigation Measure Name and Description	Implementation and Timing	Fiscal Responsibility	Monitoring Responsibility
All fueling done at the job site will provide containment to the degree that any spill will be unable to enter the channel or damage stream vegetation. Replacement of engine fluids, when necessary, shall be done outside of the channel area. Fluids will be collected in drip pans, stored in appropriate containers, and properly recycled or disposed of offsite. All equipment fluids shall be stored in a secure area away from the channel. Quantities greater than 55 gallons will be provided with a secondary containment capable of containing 110 percent of the primary container.			
MITIGATION HAZ-3: No equipment servicing shall be done in the stream channel or immediate floodplain, unless equipment stationed in these locations cannot be readily relocated i.e., pumps, generators. • Any equipment that can be readily moved out of the channel will not be serviced in the channel or immediate floodplain. • All servicing of equipment done at the job site will provide containment to the degree that any spill will be unable to enter the channel or damage stream vegetation. • If emergency repairs are required in the field, only those repairs necessary to move equipment to a more secure location will be done in the channel or floodplain. • If emergency repairs are required, containment will be provided equivalent to that done for fueling or servicing.	City of East Palo Alto and SCVWD Timing: Throughout construction phase	JPA Member Agencies	San Mateo County Department of Public Works
MITIGATION HYD-1: Sediment retention measures such as silt fencing, straw bales, and straw or coir wattles shall be installed on both sides of the levee for the entire length of the project, to prevent any loose material from falling or sliding into the creek during the construction process. Sediment retention measures, most likely silt fencing in this case, shall also be installed on the outboard side of the levee slopes where use of reinforced earth is planned. All sediment retention measures installed shall be maintained in accordance with the manufacturer's recommendations and/or with the installation and maintenance recommendations provided in the California Storm Water BMP Handbook. Proper removal and disposal of collected sediments and fencing shall be achieved upon completion of project construction. Water will not be allowed to drain directly into the creek channels.	City of East Palo Alto and SCVWD Timing: Throughout construction phase	JPA Member Agencies	San Mateo County Department of Public Works

Mitigation Measure Name and Description	Implementation and Timing	Fiscal Responsibility	Monitoring Responsibility
MITIGATION HYD-2: No debris, soil, silt, sand, cement, concrete, or washings thereof, or other construction related materials or wastes, oil or petroleum products or other organic or earthen material shall be allowed to enter into or be placed where it may be washed by rainfall or runoff into channel or stream waters, or into the delineated wetland areas on the outside of the creek levees	City of East Palo Alto and SCVWD Timing: Throughout construction phase	JPA Member Agencies	San Mateo County Department of Public Works
MITIGATION HYD-3: For tidal areas, a downstream cofferdam will be constructed to prevent the work area from being inundated by tidal flows. By isolating the work area from tidal flows, water quality impacts will be minimized. • Installation of cofferdams will begin at low tide. • Cofferdams in tidal areas can be made from earthen material. If earth is used, the downstream and upstream faces shall be covered by a protected covering (e.g., plastic or fabric) if needed to minimize erosion.	City of East Palo Alto and SCVWD Timing: Throughout construction phase	JPA Member Agencies	San Mateo County Department of Public Works
MITIGATION HYD-4: All temporary diversion structures shall be removed within 48 hours of completion of work. Flows shall be restored in a manner that minimizes erosion. When diversion structures are removed, to the extent practicable, the ponded flows will be directed into the low-flow channel within the work site to minimize downstream water quality impacts. Flows shall gradually be restored to the channel to avoid a surge of water that would cause erosion or scouring. Bypassed flows can be slowly reintroduced into the dewatered area by leaving a silt barrier in place to allow water to slow and drop sediment to the extent possible. Mitigation Measures HAZ-01, HAZ-02 and HAZ-03 are also proposed to prevent fueling of equipment on the levee. All materials will be properly contained and stored in the designated construction staging areas that are located outside of the channels and levee area. Thus, potential water quality degradation from construction activities will be avoided.	City of East Palo Alto and SCVWD Timing: Throughout construction phase	JPA Member Agencies	San Mateo County Department of Public Works
Mitigation NOI-1: Minimize Disturbances to Surrounding Neighborhoods. The City of East Palo Alto and SCVWD shall implement the following practices to minimize disturbances to neighborhoods surrounding work sites.	City of East Palo Alto and SCVWD Timing: Throughout construction phase	JPA Member Agencies	San Mateo County Department of Public Works

Mitigation Measure Name and Description	Implementation and Timing	Fiscal Responsibility	Monitoring Responsibility
1. Work shall be conducted in accordance with the City of East Palo Alto and Palo Alto Noise Ordinances. 2. Internal combustion engines shall be equipped with adequate mufflers so that no hourly noise levels above 85 dBA Leq are produced at 100 feet from the source. 3. Excessive idling of vehicles will be prohibited. 4. Levee traffic shall be limited to a speed of 15 miles per hour.			
MITIGATION TRAF-1: The City of East Palo Alto and SCVWD shall implement the following public safety measures during maintenance: 1. Construction signs shall be posted at job sites warning the public of construction work and to exercise caution. 2. When necessary, a person shall be provided for traffic control. 3. If needed, a lane shall be blocked off to allow for trucks to pull into and out of the access points. Where work is proposed adjacent to the recreational trail, warning signs shall be posted several feet beyond the limits of work.	City of East Palo Alto and SCVWD Timing: Throughout construction phase	JPA Member Agencies	San Mateo County Department of Public Works

SECTION 5. DOCUMENT CONTRIBUTORS

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SECTION 6. REFERENCES

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APPENDIX C

SAN FRANCISQUITO CREEK LEVEE PROJECT

Hydraulic Impact Analysis

Hydraulic Impact Analysis for San Francisquito Creek Levee Restoration Project

Provided by Northwest Hydraulics, Inc.

for the
Santa Clara Valley Water District

January, 2001

Memorandum of findings and data.

HEC-RAS Hydraulic Impact Analysis

San Francisquito Creek Levee Restoration Project
January 31, 2001

This memorandum presents and discusses the HEC-RAS 3.0 results for the San Francisquito Creek Levee Restoration Project. The actual RAS output data is compiled in an Excel spreadsheet <ras_results.xls>. Additionally, the following three sensitivity plots show the effect of varying the downstream water depth, high flow bridge method, and cross sectional spacing, respectively: s1958_hdwn.pdf, s1958_bridge.pdf, and s1958_dx.pdf.

1.0 HEC-RAS 3.0 MODEL

The HEC-RAS model was run using the following three basic geometry files:

Existing 1999 Conditions – Originally the SCVWD's <*.g01> file.
Proposed 1958 Conditions – Originally the SCVWD's <*.g04> file.
Woodland 2001 Conditions – Originally the SCVWD's <*.g03> file.

All three geometry files were run with 3,600 cfs and 6,000 cfs. Additionally, each geometry was run with and without the HEC-RAS 3.0 lateral weir option (this was done to model the flow overtopping the levees and to compare the results with and without overtopping). Finally, three sensitivity runs were made using the "Proposed 1958 Conditions" without the lateral weir. Thus, a total of 15 runs were made.

After the geometry files were obtained from the SCVWD, all cross sections upstream of RS 17570 were eliminated. The upper sections were eliminated because only the reach between Newell Road Bridge and the San Francisco Bay was of interest for this study – these cross sections can easily be reinstated if the conditions upstream of Newell Road Bridge are later desired. Also, all cross sections below RS 600 were eliminated (the downstream cross sections were removed to eliminate any "problems" associated with inundation of the tidal marsh region) and the water surface elevation at RS 600 was set to 8.0 ft. For all bridges, the low flow modeling method was set to "energy" and the high flow method was set to "pressure/weir" – default bridge modeling coefficients were used.

First, the model was run without the lateral weir option. Then, a lateral weir was introduced in regions where the water surface was above the levee elevation. The crest of the lateral weir was set to the lowest levee elevation and default weir modeling coefficients were used. HEC-RAS 3.0 uses an iterative procedure to determine the amount of flow overtopping the weir, removes the overtopping flow from the main channel flow, and computes the wse accordingly. Thus, for each of the three geometries (and for both the 3,600 cfs and 6,000 cfs flows), the wse with and without overtopping was computed. Then, comparisons were made showing the wse, change in wse between alternatives, and main channel flow for each of the three geometries.

2.0 RESULTS

The results of the HEC-RAS 3.0 runs are tabulated in an Excel spreadsheet entitled <ras_results.xls>. A separate data worksheet exists for each of the three geometries (i.e. "Existing 1999", "Proposed 1958", and "Woodland 2001"). Each worksheet contains the results of four HEC-RAS 3.0 runs (3,600 cfs with and without the weir, and 6,000 cfs with and without the weir). In addition to the three data worksheets, the Excel spreadsheet contains seven graphs – each graph is on a separate worksheet and all graphs pertain the 6,000 cfs flow.

The purpose of running the lower flow (3,600 cfs) was to determine the "break-out" flow for the "Existing 1999" conditions. From the RAS results, it was determined that 3,600 cfs was the "break-out flow" for the "Existing 1999" conditions. The "break-out" occurs downstream of the Hwy 101 bridge at RS 5800 over the right levee. It should be noted that at RS 5800 the right levee dips approximately 1 ft, and if this dip is removed, the "break-out" flow increases to approximately 4,000 cfs.

The purpose of running the higher flow (6,000 cfs) was to determine the amount of water overtopping the levees and to determine the wse in the channel with and without the overtopping (i.e. with and without the lateral weir option). The following seven graphs in <ras_results.xls> depict the RAS results for the various 6,000 cfs runs:

Existing 6000 wse – This graph shows the 6,000 cfs wse for the "Existing 1999" conditions with and without the lateral weir. In this case, water overtops the weir upstream and downstream of the Hwy 101 bridge. This overtopping occurs when the wse is above the crest of the lowest levee. Therefore, the "with weir" wse (blue line) is below the "without weir" wse (purple line).

Proposed 1958 wse – This graph shows the 6,000 cfs wse for the "Proposed 1958" conditions with and without the lateral weir. Here, the levees have been raised and water does not overtop the levees upstream of the Hwy 101 bridge and only very minimal overtopping occurs downstream of Hwy 101 (in this case, nearly all of the 6,000 cfs remains in the channel). Thus, both the "with weir" and without weir" wse are identical.

Woodland 2001 wse – This graphs shows the 6,000 cfs wse for the "Woodland 2001" conditions with and without the lateral weir. In this case, water does not overtop the levees upstream of the Hwy 101 bridge; however, water does overtop the levees downstream of the Hwy 101 bridge.

Comp wse – This graph compares the 6,000 cfs wse for the three geometries with the lateral weir. The "Existing 1999" wse (blue line) is lowest because, in this case, the levees are lowest and more water overtops the levees and leaves the main channel. The "Proposed 1958" wse (purple line) is highest because, in this case, the levees are highest and almost all of the 6,000 cfs remains in the main channel.

Comp dWse – This graphs show the difference in wse with the lateral weir between: (1) the "Proposed 1958" and "Existing 1999" conditions and (2) the "Woodland 2001" and "Exsiting 1999" conditions.

Comp flow – This graph show the main channel flow with the lateral weir for the three conditions. The "Existing 1999" flow is lowest because, in this case, the levees are lower and a significant amount of water overtops the levees and leaves the main channel. The "Proposed 1958" flow is highest because the levees are higher and contain almost the entire 6,000 cfs in the main channel.

Comp levees – This graph show the right and left levee elevations for the three scenarios.

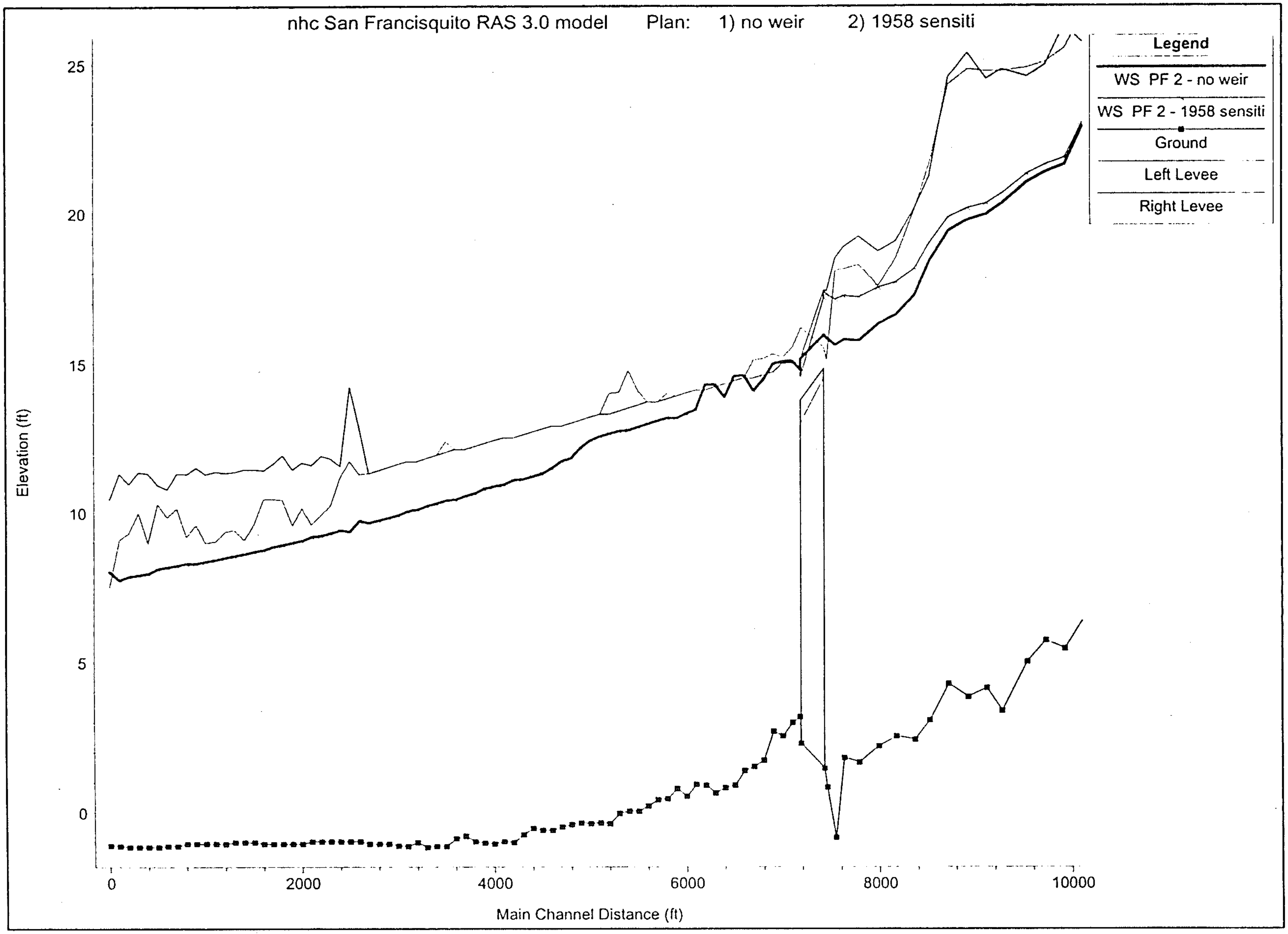
3.0 Sensitivity

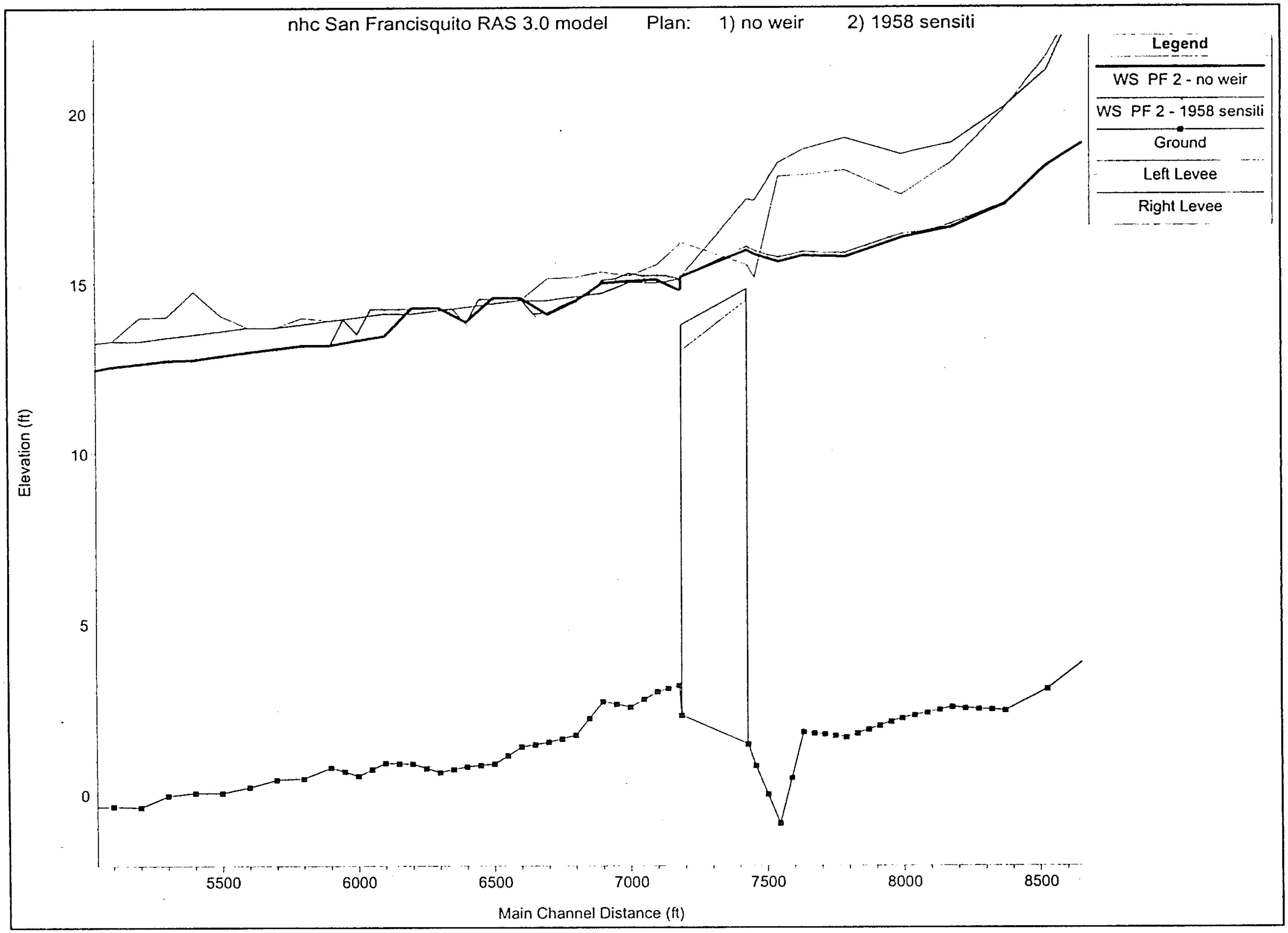
Three sensitivity runs were performed to ascertain the effect of the following on the 6,000 cfs wse: (1) the downstream boundary condition, (2) the cross sectional spacing, and (3) the high flow bridge method at Hwy 101. All sensitivity tests were run without the weir option with the "Proposed 1958" conditions. The following PDF files show the results of the sensitivity analysis:

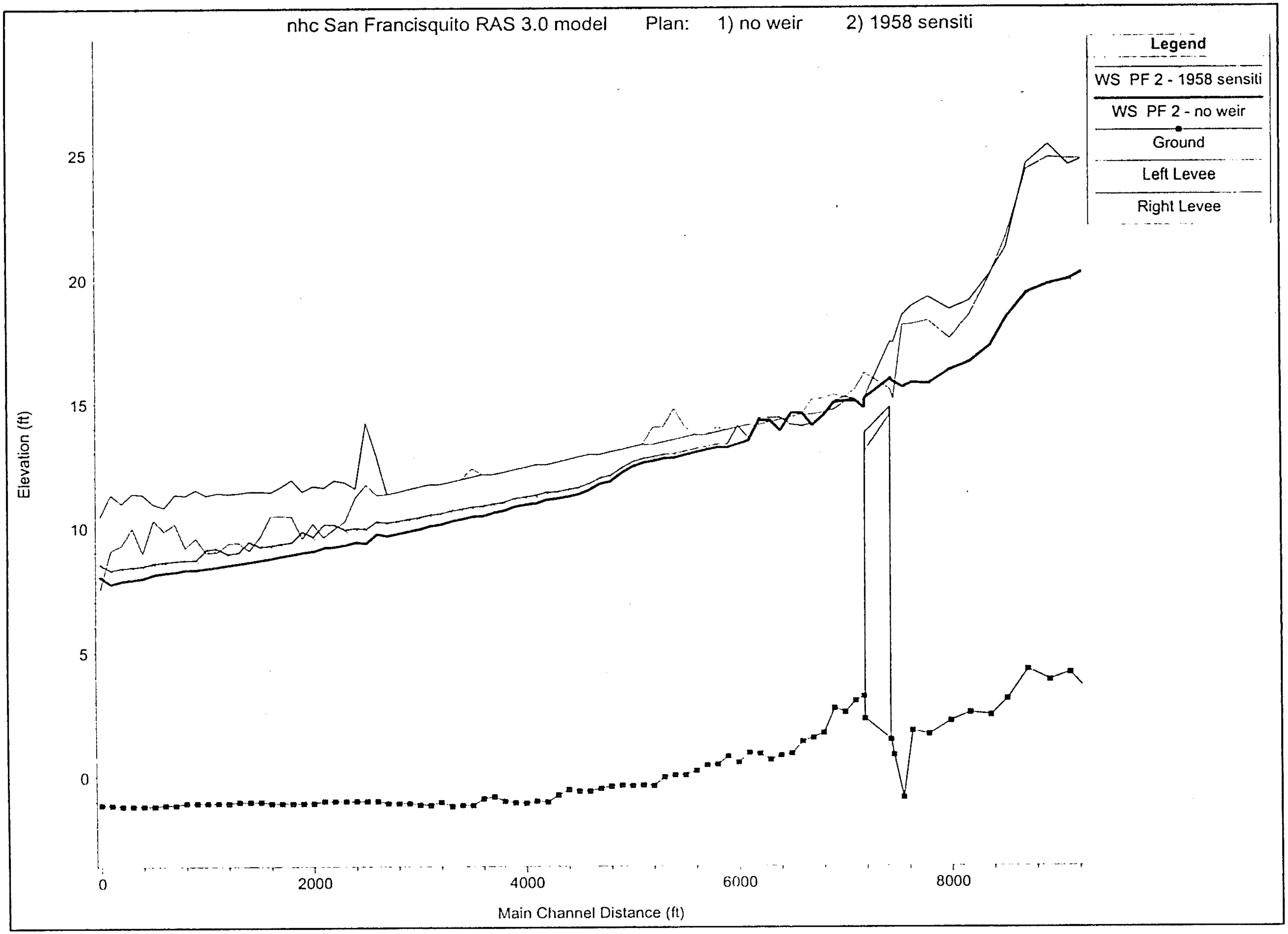
s1958_hdwn.pdf – This graph shows the effect of increasing the downstream wse boundary condition from 8.0 ft to 8.5 ft. As expected "8.5 ft" wse is higher than the "8.0 ft" wse; however, the increase is rather mild. In addition, the "8.5 ft" wse remains below the levees (except very near the d/s boundary) and the effect of the d/s boundary does not propagate upstream of the Hwy 101 bridge.

s1958_dx.pdf – This graph shows the effect of reducing the cross sectional spacing to 50 ft near the Hwy 101 bridge. The graph show that reducing the cross sectional spacing does not significantly alter the wse.

s1958_bridge – This graph shows the effect of using the "Energy method" instead of the "Pressure/Weir method" for the high flow computations at the Hwy 101 bridge. The "Energy method" produces a higher wse over the bridge than the "Pressure/weir method". Since there is no calibration data for high flows, it is not possible to definitively determine the "correct" wse. However, it is standard practice to use the "Pressure/weir method" for high flow bridge computations. Furthermore, a very small value of C_d must be used in the "Pressure/weir method" to match the "Energy method" solution (the RAS manual recommends $0.7 < C_d < 0.9$; however, $C_d \approx 0.4$ must be used to match the "Energy method" wse). This suggests that the "Energy method" may be less accurate that the "Pressure/weir method".


nhc San Francisquito RAS 3.0 model Plan: 1) no weir 2) 1958 sensiti
Legend
WS PF 2 - no weir
WS PF 2 - 1958 sensiti
Ground
Left Levee
Right Levee
Elevation (ft)
25
20
15
10
5
0
0
2000
4000
6000
8000
10000
Main Channel Distance (ft)


nhc San Francisquito RAS 3.0 model Plan: 1) no weir 2) 1958 sensiti
Legend
WS PF 2 - no weir
WS PF 2 - 1958 sensiti
Ground
Left Levee
Right Levee
Elevation (ft)
20
15
10
5
0
5500
6000
6500
7000
7500
8000
8500
Main Channel Distance (ft)


nhc San Francisquito RAS 3.0 model Plan: 1) no weir 2) 1958 sensiti
Legend
WS PF 2 - 1958 sensiti
WS PF 2 - no weir
Ground
Left Levee
Right Levee
Elevation (ft)
25
20
15
10
5
0
0
2000
4000
6000
8000
Main Channel Distance (ft)

San Francisquito RAS 3.0 Results (Existing 1999 Conditions)

Existing 1999 Conditions

NO WEIR & Q = 3,600 cfs

River Sta (ft)	Thalweg (ft)	Left Levee (ft)	Rt Levee (ft)	Flow (cfs)	Wse (ft)	Crit Wse (ft)	Velocity (ft/s)	Fr Number
17570	18.64	44.04	42.6	3600	32.67	27.24	6.06	0.35
17354	18.26	42.43	43.08	3600	32.47	26.51	5.83	0.34
17231	17.44	41.25	40.18	3600	31.95	26.95	7.38	0.43
17105	17.2	42.57	40.98	3600	31.89	26.27	6.51	0.38
16919	15.78	41.04	41.42	3600	31.69	26.15	6.28	0.36
16763	16.97	39.26	41.12	3600	31.39	25.73	6.72	0.38
16612	17.74	40.72	40.92	3600	31.35	25.28	5.71	0.32
16420	17.46	39.74	40.11	3600	31.13	24.73	5.89	0.33
16191	16.24	38.7	38.33	3600	30.27	25.64	8.16	0.47
15989	16.17	36.88	38.32	3600	29.83	25.27	8.04	0.47
15815	16.09	38.09	37.51	3600	29.49	24.58	7.81	0.44
15641	15.8	37.01	35.91	3600	29.32	23.9	6.96	0.4
15348	14.24	37.7	37.36	3600	29	23.13	6.41	0.36
15100	14.21	36.43	36.99	3600	28.66	22.76	6.48	0.37
14818	14.18	35.07	35.36	3600	28.31	22.26	6.46	0.37
14670	14.1	35.93	33.51	3600	28.31	21.38	5.32	0.3
14476	13.18	33.82	34.01	3600	28.2	20.85	5.09	0.28
14406	12.4	34.08	34.44	3600	27.91	22.01	6.23	0.35
14288	12.76	34.12	33.6	3600	27.16	22.51	8.41	0.48
14082	11.92	33.17	33.15	3600	25.84	22.95	10.42	0.59
13872	11.81	32.18	31.6	3600	25.41	21.15	8.92	0.54
13653	10.78	31.3	33.47	3600	25.38	19.41	6.51	0.37
13490.3	10.3	32.38	32.73	3600	25.17	19.02	6.47	0.37
13453.2	11.07	32.77	32.95	3600	25.21	18.83	5.91	0.33
13444	11.18	32.86	33.44	3600	25.14	18.83	6.22	0.32
13329	10.97	33.1	32.89	3600	25.02	17.98	6.22	0.31
13315	10.96	32.2	32.35	3600	25.07	18.04	5.73	0.3
13302	10.93	31.44	31.89	3600	25.02	18.16	5.88	0.32
13225	10	31.03	30.4	3600	24.96	18.44	5.8	0.32
13051	10.26	30.67	30.33	3600	24.62	18.38	6.45	0.36
12843	10.03	29.55	30.04	3600	24.45	17.46	5.89	0.31
12627	8.84	30.11	30.07	3600	23.94	17.73	6.91	0.38
12450	8.2	30	29.46	3600	23.47	17.76	7.5	0.41
12317.6	9.36	28.27	29.41	3600	23.25	17.61	7.25	0.41
12173	8.61	30	29.6	3600	23.16	16.83	6.17	0.37
11991	9.38	29.83	29.36	3600	23.03	16.17	5.49	0.3
11766	6.77	28.96	28.48	3600	22.4	16.49	7.05	0.4
11563	6.96	27.94	27.95	3600	21.42	16.83	8.88	0.5
11370	7.82	27.99	28.52	3600	21.32	15.89	6.86	0.4
11257.4	6.06	27.92	28.38	3600	20.85	15.83	7.83	0.46
11231	6.06	27.92	28.38	3600	20.76	15.83	7.91	0.47
11217	7.74	30.92	30.92	3600	20.83	14.66	7.33	0.36
11193	7.1	30.87	30.95	3600	20.75	14.41	7.45	0.37
11155.5	6.77	27.77	27.29	3600	20.97	14.24	5.17	0.28

10976	6.39	27.42	27.1	3600	20.19	15.39	7.59	0.45
10716	6.38	26.68	25.71	3600	19.39	14.7	8.03	0.48
10530	5.45	25.51	26.3	3600	18.3	15.01	9.48	0.57
10333	5.72	25.06	24.97	3600	17.91	13.47	7.91	0.49
10143	5.01	24.87	24.58	3600	17.56	12.91	7.09	0.43
9879	3.4	24.76	24.81	3600	16.93	12.13	7.3	0.43
9721	4.14	24.75	24.5	3600	16.63	11.76	7.11	0.41
9529	3.85	24.81	25.35	3600	16.41	11.34	6.51	0.4
9324	4.28	24.06	24.56	3600	16.13	11.54	6.61	0.39
9128	3.08	21.62	21.23	3600	15.31	11.89	8.51	0.53
8973	2.44	16.72	20.14	3600	14.53	11.77	9.66	0.61
8778	2.54	16.46	19.09	3600	13.97	11.1	9.4	0.59
8595	2.22	14.97	18.75	3600	13.69	10.21	8.37	0.52
8390	1.67	14	19.24	3600	13.2	9.93	8.42	0.54
8233	1.82	14	18.88	3600	13.2	8.93	6.96	0.43
8145.3	-0.86	14.05	18.51	3600	13.09	8.79	7.04	0.43
8057.6	0.84	15.14	17.41	3600	13.21	8.38	5.54	0.34
8030	1.47	15.52	17.45	3600	13.29	7.51	4.56	0.26
7787	2.3	16.2	15.16	3600	12.72	7.59	5.01	0.29
7779.3	3.19	16.1	15.09	3600	12.7	7.82	5.13	0.3
7700	3	15.52	14.99	3600	12.68	7.55	4.81	0.3
7600	2.55	15.2	15	3600	12.65	7.43	4.47	0.28
7500	2.71	15.31	13.98	3600	12.56	7.58	4.62	0.3
7400	1.73	15.15	13.96	3600	12.42	7.72	4.95	0.32
7300	1.53	15.12	13.58	3600	12.19	8.09	5.68	0.39
7200	1.39	13.39	13.91	3600	12.12	7.57	5.31	0.38
7100	0.9	14.02	13.14	3600	12.09	7.45	4.93	0.34
7000	0.82	13.36	12.78	3600	11.96	7.47	5.29	0.37
6900	0.65	12.86	12.61	3600	11.83	7.62	4.99	0.36
6800	0.9	13.36	12.45	3600	11.69	7.41	4.92	0.34
6700	0.93	13.47	13.17	3600	11.41	7.92	5.8	0.42
6600	0.54	13.25	12.2	3600	11.31	7.1	5.65	0.42
6500	0.79	13.39	12.48	3600	11.2	6.99	5.69	0.42
6400	0.46	13.99	12.56	3600	11.18	6.94	5.03	0.38
6300	0.43	13.41	11.81	3600	11.08	7.94	5.04	0.39
6200	0.21	13.36	12.12	3600	10.99	7.94	4.91	0.38
6100	0.04	14.05	12.28	3600	10.89	7.78	4.84	0.37
6000	0.04	14.76	12.15	3600	10.78	7.86	5.09	0.4
5900	-0.04	14.3	11.9	3600	10.75	6.34	4.69	0.37
5800	-0.38	13.99	10.7	3600	10.65	7.29	4.66	0.36
5700	-0.36	11.92	11.81	3600	10.55	6.1	4.52	0.36
5600	-0.38	12	11.65	3600	10.41	7.1	4.7	0.37
5500	-0.36	12.45	11.6	3600	10.24	6.91	5.06	0.38
5400	-0.41	12.58	12.05	3600	10.02	6.08	5.63	0.42
5300	-0.49	12.05	11.84	3600	9.96	5.71	5.3	0.38
5200	-0.6	11.63	12.02	3600	9.8	6.55	5.63	0.41
5100	-0.6	12	12.08	3600	9.72	5.88	5.67	0.4
5000	-0.54	12.08	11.97	3600	9.66	5.91	5.59	0.39
4900	-0.75	10.9	11.86	3600	9.6	5.75	5.28	0.38
4800	-1.02	11.23	11.55	3600	9.56	5.36	4.65	0.33
4700	-0.99	11.04	10.91	3600	9.45	5.15	4.82	0.36

4600	-1.07	11.57	11.2	3600	9.41	5.16	4.64	0.34
4500	-1.05	11.07	11.09	3600	9.35	5.55	4.62	0.34
4400	-0.99	11.31	10.67	3600	9.25	5.27	4.88	0.37
4300	-0.81	10.91	10.59	3600	9.18	4.98	4.76	0.36
4200	-0.89	11.78	10.46	3600	9.11	5.99	4.82	0.37
4100	-1.16	12.36	10.37	3600	9.09	5.51	4.43	0.33
4000	-1.16	11.22	10.29	3600	9.03	5.48	4.49	0.34
3900	-1.19	11.3	10.23	3600	8.99	5.43	4.48	0.33
3800	-1.03	10.5	10.5	3600	8.91	5.73	4.65	0.36
3700	-1.16	10.77	10.5	3600	8.87	5.36	4.5	0.34
3600	-1.14	11.03	10.31	3600	8.8	5.41	4.63	0.35
3500	-1.08	10.05	10.42	3600	8.75	5.32	4.65	0.35
3400	-1.08	9.97	10.08	3600	8.71	5.28	4.6	0.35
3300	-1.08	10.05	10.14	3600	8.66	5.37	4.58	0.35
3200	-0.99	11.27	12.84	3600	8.7	3.65	3.7	0.26
3100	-0.99	11.71	14.21	3600	8.53	4.83	4.63	0.33
3000	-0.99	11.18	11.54	3600	8.55	4.82	4.17	0.3
2900	-0.99	10.22	11.79	3600	8.5	5	4.3	0.32
2800	-0.99	9.92	11.87	3600	8.47	4.7	4.32	0.32
2700	-0.99	9.59	11.57	3600	8.44	4.78	4.21	0.31
2600	-1.08	10.14	11.65	3600	8.39	4.71	4.35	0.32
2500	-1.08	9.56	11.43	3600	8.36	4.75	4.27	0.32
2400	-1.08	10.41	11.9	3600	8.32	4.6	4.29	0.32
2300	-1.08	10.44	11.62	3600	8.29	4.51	4.22	0.31
2200	-1.08	10.44	11.4	3600	8.25	4.64	4.28	0.31
2100	-1.02	9.59	11.43	3600	8.23	4.56	4.18	0.31
2000	-1.02	9.06	11.43	3600	8.21	4.48	4.12	0.3
1900	-1.02	9.39	11.35	3600	8.19	4.5	4.11	0.3
1800	-1.08	9.34	11.32	3600	8.17	4.37	4.06	0.29
1700	-1.07	9.01	11.36	3600	8.15	4.32	4.04	0.29
1600	-1.07	8.96	11.27	3600	8.13	4.13	3.92	0.28
1500	-1.07	9.57	11.49	3600	8.11	4.17	3.91	0.28
1400	-1.07	9.18	11.27	3600	8.1	4.17	3.65	0.27
1300	-1.15	10.14	11.3	3600	8.08	3.49	3.65	0.27
1200	-1.15	9.84	10.78	3600	8.05	3.46	3.64	0.26
1100	-1.18	10.28	10.92	3600	8.03	3.16	3.6	0.26
1000	-1.18	8.96	11.3	3600	7.99	3.18	3.79	0.27
900	-1.18	9.98	11.34	3600	7.97	3.08	3.75	0.27
800	-1.18	9.28	10.95	3600	7.95	3.13	3.63	0.26
700	-1.15	9.07	11.3	3600	7.91	3.13	3.72	0.27
600	-1.13	7.5	10.42	3600	8	3.13	2.35	0.17

NO WEIR & Q = 6,000 cfs					WITH WEIR & Q = 3,600 cfs				
Flow (cfs)	Wse (ft)	Crit Wse (ft)	Velocity (ft/s)	Fr Number	Flow (cfs)	Wse (ft)	Crit Wse (ft)	Velocity (ft/s)	Fr Number
6000	36.89	29.48	6.89	0.34	3600	32.67	27.24	6.06	0.35
6000	36.75	28.8	6.35	0.34	3600	32.47	26.51	5.83	0.34
6000	36.21	29.82	7.95	0.43	3600	31.95	26.95	7.38	0.43
6000	36.16	28.88	7.17	0.37	3600	31.89	26.27	6.51	0.38
6000	35.96	28.6	7.04	0.36	3600	31.69	26.15	6.28	0.36
6000	35.64	28.35	7.56	0.38	3600	31.39	25.73	6.72	0.38
6000	35.64	27.71	6.51	0.32	3600	31.35	25.28	5.71	0.32
6000	35.41	27.14	6.72	0.33	3600	31.13	24.73	5.89	0.33
6000	34.42	28.63	9.19	0.47	3600	30.27	25.64	8.16	0.47
6000	34.08	28.24	8.79	0.46	3600	29.83	25.27	8.04	0.47
6000	33.72	27.39	8.83	0.45	3600	29.49	24.58	7.81	0.44
6000	33.63	26.63	7.75	0.4	3600	29.32	23.9	6.96	0.4
6000	33.34	25.65	7.19	0.36	3600	29	23.13	6.41	0.36
6000	33.05	25.42	7.16	0.36	3600	28.66	22.76	6.48	0.37
6000	32.74	24.9	7.05	0.37	3600	28.31	22.26	6.46	0.37
6000	32.75	23.71	5.96	0.3	3600	28.31	21.38	5.32	0.3
6000	32.65	23.27	5.66	0.29	3600	28.2	20.85	5.09	0.28
6000	32.25	24.41	7.2	0.34	3600	27.91	22.01	6.23	0.35
6000	31.46	25.58	9.28	0.48	3600	27.16	22.51	8.41	0.48
6000	30.09	25.76	11.36	0.6	3600	25.84	22.95	10.42	0.59
6000	29.91	24.62	9.15	0.51	3600	25.41	21.15	8.92	0.54
6000	29.87	22.06	7.22	0.36	3600	25.38	19.41	6.51	0.37
6000	29.71	21.64	6.93	0.37	3600	25.17	19.02	6.47	0.37
6000	29.72	21.29	6.6	0.33	3600	25.21	18.83	5.91	0.33
6000	29.49	21.2	7.53	0.33	3600	25.14	18.83	6.22	0.32
6000	29.1	20.34	7.87	0.34	3600	25.02	17.98	6.22	0.31
6000	29.26	20.48	6.8	0.32	3600	25.07	18.04	5.73	0.3
6000	29.22	20.71	6.9	0.33	3600	25.02	18.16	5.88	0.32
6000	29.17	20.96	6.69	0.33	3600	24.96	18.44	5.8	0.32
6000	28.79	21.03	7.46	0.37	3600	24.62	18.38	6.45	0.36
6000	28.59	19.99	7.02	0.34	3600	24.45	17.46	5.89	0.31
6000	27.99	20.55	8.11	0.4	3600	23.94	17.73	6.91	0.38
6000	27.44	20.73	8.82	0.44	3600	23.47	17.76	7.5	0.41
6000	27.22	20.52	8.48	0.42	3600	23.25	17.61	7.25	0.41
6000	27.3	19.55	6.61	0.35	3600	23.16	16.83	6.17	0.37
6000	27.14	18.51	6.37	0.32	3600	23.03	16.17	5.49	0.3
6000	26.42	19.37	8.04	0.42	3600	22.4	16.49	7.05	0.4
6000	25.13	20.02	10.45	0.55	3600	21.42	16.83	8.88	0.5
6000	25.15	18.6	7.97	0.41	3600	21.32	15.89	6.86	0.4
6000	24.66	18.94	8.85	0.48	3600	20.85	15.83	7.83	0.46
6000	24.57	18.95	8.93	0.48	3600	20.76	15.83	7.91	0.47
6000	24.34	17.26	9.56	0.42	3600	20.83	14.66	7.33	0.36
6000	24.17	17.11	9.82	0.43	3600	20.75	14.41	7.45	0.37
6000	24.65	16.45	6.29	0.31	3600	20.97	14.24	5.17	0.28

6000	23.7	18.2	8.89	0.47	3600	20.19	15.39	7.59	0.45
6000	22.87	17.75	9.25	0.5	3600	19.39	14.7	8.03	0.48
6000	21.54	17.97	11.09	0.62	3600	18.3	15.01	9.48	0.57
6000	21.27	16.43	9.03	0.51	3600	17.91	13.47	7.91	0.49
6000	20.92	15.39	8.26	0.45	3600	17.56	12.91	7.09	0.43
6000	20.17	14.81	8.69	0.48	3600	16.93	12.13	7.3	0.43
6000	19.78	14.24	8.6	0.48	3600	16.63	11.76	7.11	0.41
6000	19.58	13.78	7.72	0.43	3600	16.41	11.34	6.51	0.4
6000	19.21	13.74	8.03	0.43	3600	16.13	11.54	6.61	0.39
6000	18.14	14.58	10.25	0.59	3600	15.31	11.89	8.51	0.53
6000	17.02	14.57	11.91	0.69	3600	14.53	11.77	9.66	0.61
6000	16.13	13.89	12.11	0.71	3600	13.97	11.1	9.4	0.59
6000	15.8	12.8	10.73	0.64	3600	13.69	10.21	8.37	0.52
6000	15.11	12.48	10.82	0.66	3600	13.2	9.93	8.42	0.54
6000	15.07	11.28	9.3	0.53	3600	13.2	8.93	6.96	0.43
6000	14.8	11.17	9.62	0.55	3600	13.09	8.79	7.04	0.43
6000	15.06	10.26	7.56	0.42	3600	13.21	8.38	5.54	0.34
6000	15.2	9.09	6.35	0.33	3600	13.29	7.51	4.56	0.26
6000	14.13	9.23	7.23	0.39	3600	12.72	7.59	5.01	0.29
6000	14.08	9.45	7.38	0.41	3600	12.7	7.82	5.13	0.3
6000	14.08	9.27	6.78	0.4	3600	12.68	7.55	4.81	0.3
6000	14.03	9.05	6.3	0.38	3600	12.65	7.43	4.47	0.28
6000	14.08	9.27	5.34	0.34	3600	12.56	7.58	4.62	0.3
6000	14	9.4	5.2	0.33	3600	12.42	7.72	4.95	0.32
6000	13.61	10.12	6.62	0.42	3600	12.19	8.09	5.68	0.39
6000	13.1	9.97	7.61	0.51	3600	12.12	7.57	5.31	0.38
6000	13.24	9.56	6.12	0.5	3600	12.09	7.45	4.93	0.34
6000	13.54	9.59	1.68	0.12	3600	11.96	7.47	5.29	0.37
6000	13.53	9.58	1.44	0.1	3600	11.83	7.62	4.99	0.36
6000	13.52	9.32	1.56	0.1	3600	11.69	7.41	4.92	0.34
6000	12.36	9.81	8.28	0.58	3600	11.41	7.92	5.8	0.42
6000	12.98	9.74	2.75	0.19	3600	11.31	7.1	5.65	0.42
6000	12.65	9.81	5.49	0.38	3600	11.2	6.99	5.69	0.42
6000	12.66	9.46	4.41	0.3	3600	11.18	6.94	5.03	0.38
6000	12.55	9.5	4.73	0.33	3600	11.08	7.94	5.04	0.39
6000	12.45	9.35	4.83	0.34	3600	10.99	7.94	4.91	0.38
6000	12.41	9.19	4.43	0.31	3600	10.89	7.78	4.84	0.37
6000	12.35	9.28	4.59	0.34	3600	10.78	7.86	5.09	0.4
6000	12.37	9.12	3.69	0.26	3600	10.75	6.34	4.69	0.37
6000	12.4	8.95	2.3	0.16	3600	10.65	7.29	4.66	0.36
6000	12.43	8.79	1.19	0.08	3600	10.55	6.1	4.52	0.36
6000	12.43	8.77	1.15	0.08	3600	10.41	7.1	4.7	0.37
6000	12.38	8.53	1.7	0.12	3600	10.24	6.91	5.06	0.38
6000	11.49	8.55	7.38	0.5	3600	10.02	6.08	5.62	0.42
6000	12.01	8.12	1.86	0.13	3600	9.96	5.71	5.3	0.38
6000	12.03	8.33	1.17	0.08	3600	9.8	6.55	5.63	0.41
6000	11	7.91	7.83	0.53	3600	9.72	5.88	5.67	0.4
6000	10.9	7.85	7.76	0.51	3600	9.66	5.91	5.59	0.39
6000	11.44	7.77	2.29	0.15	3600	9.6	5.75	5.28	0.38
6000	10.79	7.39	6.43	0.43	3600	9.56	5.36	4.65	0.33
6000	11.2	7.56	1.34	0.09	3600	9.45	5.15	4.82	0.36

6000	10.5	7.4	6.48	0.44	3600	9.41	5.16	4.64	0.34
6000	10.41	7.39	6.45	0.45	3600	9.35	5.55	4.62	0.34
6000	10.75	7.53	2.87	0.2	3600	9.25	5.27	4.88	0.37
6000	10.75	7.35	2.39	0.17	3600	9.18	4.98	4.76	0.36
6000	10.71	7.46	2.76	0.2	3600	9.11	5.99	4.82	0.37
6000	10.7	7.01	2.74	0.19	3600	9.09	5.51	4.43	0.33
6000	10.71	6.99	2.03	0.14	3600	9.03	5.48	4.49	0.34
6000	10.71	6.91	1.85	0.13	3600	8.99	5.43	4.48	0.33
6000	10.72	7.08	1.4	0.1	3600	8.91	5.73	4.65	0.36
6000	10.1	6.84	6.11	0.42	3600	8.87	5.36	4.5	0.34
6000	10.45	6.89	1.95	0.14	3600	8.8	5.41	4.63	0.35
6000	9.76	6.81	6.51	0.46	3600	8.75	5.32	4.65	0.35
6000	10.16	6.81	2.15	0.16	3600	8.71	5.28	4.6	0.35
6000	10.16	6.78	1.95	0.14	3600	8.66	5.37	4.58	0.35
6000	9.71	5.67	5.29	0.35	3600	8.7	3.65	3.7	0.26
6000	9.34	6.22	6.81	0.46	3600	8.53	4.83	4.63	0.33
6000	9.38	6.11	6.08	0.42	3600	8.55	4.82	4.17	0.3
6000	9.29	6.34	6.27	0.45	3600	8.5	5	4.3	0.32
6000	9.2	6.16	6.36	0.46	3600	8.47	4.7	4.32	0.32
6000	9.17	6.18	6.19	0.44	3600	8.44	4.78	4.21	0.31
6000	9.03	6.15	6.5	0.46	3600	8.39	4.71	4.35	0.32
6000	8.97	6.06	6.42	0.46	3600	8.36	4.75	4.27	0.32
6000	8.89	5.96	6.48	0.46	3600	8.32	4.6	4.29	0.32
6000	8.83	5.86	6.43	0.45	3600	8.29	4.51	4.22	0.31
6000	8.73	5.96	6.58	0.47	3600	8.25	4.64	4.28	0.31
6000	8.66	5.89	6.48	0.46	3600	8.23	4.56	4.18	0.31
6000	8.6	5.85	6.45	0.46	3600	8.21	4.48	4.12	0.3
6000	8.53	5.8	6.47	0.46	3600	8.19	4.5	4.11	0.3
6000	8.46	5.65	6.45	0.46	3600	8.17	4.37	4.06	0.29
6000	8.4	5.61	6.47	0.46	3600	8.15	4.32	4.04	0.29
6000	8.34	5.44	6.32	0.45	3600	8.13	4.13	3.92	0.28
6000	8.27	5.45	6.35	0.45	3600	8.11	4.17	3.91	0.28
6000	8.26	5.44	5.92	0.43	3600	8.1	4.17	3.65	0.27
6000	8.2	5.2	5.96	0.43	3600	8.08	3.49	3.65	0.27
6000	8.15	5.2	5.96	0.43	3600	8.05	3.46	3.64	0.26
6000	8.1	4.94	5.93	0.42	3600	8.03	3.16	3.6	0.26
6000	7.94	4.73	6.36	0.45	3600	7.99	3.18	3.79	0.27
6000	7.89	4.91	6.33	0.46	3600	7.97	3.08	3.75	0.27
6000	7.84	4.8	6.16	0.45	3600	7.95	3.13	3.63	0.26
6000	7.73	4.68	6.4	0.46	3600	7.91	3.13	3.72	0.27
6000	8	4.76	3.92	0.28	3600	8	3.13	2.35	0.17

WITH WEIR & Q = 6,000 cfs

Flow (cfs)	Wse (ft)	Crit Wse (ft)	Velocity (ft/s)	Fr Number
6000	36.89	29.48	6.89	0.34
6000	36.75	28.8	6.35	0.34
6000	36.21	29.82	7.95	0.43
6000	36.16	28.88	7.17	0.37
6000	35.96	28.6	7.04	0.36
6000	35.64	28.35	7.56	0.38
6000	35.64	27.71	6.51	0.32
6000	35.41	27.14	6.73	0.33
6000	34.42	28.63	9.19	0.47
6000	34.08	28.24	8.8	0.46
6000	33.72	27.39	8.83	0.45
6000	33.63	26.63	7.75	0.4
6000	33.34	25.65	7.19	0.36
6000	33.05	25.42	7.16	0.36
6000	32.74	24.9	7.05	0.37
6000	32.75	23.71	5.96	0.3
6000	32.65	23.27	5.66	0.29
6000	32.25	24.41	7.2	0.34
6000	31.46	25.58	9.29	0.48
6000	30.09	25.76	11.36	0.6
6000	29.91	24.62	9.15	0.51
6000	29.87	22.06	7.22	0.36
6000	29.71	21.64	6.93	0.37
6000	29.72	21.29	6.6	0.33
6000	29.49	21.2	7.53	0.33
6000	29.1	20.34	7.87	0.34
6000	29.26	20.48	6.8	0.32
6000	29.22	20.71	6.9	0.33
6000	29.17	20.96	6.7	0.33
6000	28.78	21.03	7.46	0.37
6000	28.59	19.99	7.02	0.34
6000	27.99	20.55	8.11	0.4
6000	27.43	20.73	8.82	0.44
6000	27.22	20.52	8.49	0.42
6000	27.3	19.55	6.61	0.35
6000	27.13	18.51	6.38	0.32
6000	26.41	19.37	8.04	0.42
6000	25.12	20.02	10.46	0.55
6000	25.15	18.6	7.97	0.41
6000	24.65	18.94	8.86	0.48
6000	24.56	18.95	8.93	0.48
6000	24.33	17.26	9.56	0.42
6000	24.17	17.11	9.82	0.43
6000	24.64	16.45	6.29	0.31

6000	23.69	18.2	8.89	0.47
6000	22.86	17.75	9.26	0.51
6000	21.52	17.97	11.11	0.62
6000	21.25	16.43	9.05	0.51
6000	20.9	15.39	8.28	0.45
6000	20.14	14.81	8.72	0.48
6000	19.75	14.24	8.63	0.48
6000	19.54	13.78	7.75	0.43
6000	19.17	13.74	8.06	0.43
6000	18.08	14.58	10.32	0.59
5999.7	16.84	14.57	12.17	0.71
5997.9	15.83	13.89	12.51	0.74
5970.4	15.41	12.77	11.22	0.68
5642.1	14.85	12.15	10.54	0.65
5207.6	15.03	10.57	8.1	0.46
4950.5	14.98	10.19	7.78	0.44
4853.6	15.15	9.41	6.06	0.33
4853.6	15.24	8.36	5.12	0.26
4853.6	13.67	8.48	6.11	0.34
4853.6	13.64	8.71	6.24	0.35
4853.6	13.63	8.49	5.78	0.35
4853.6	13.59	8.35	5.36	0.33
4853.6	13.46	8.52	5.53	0.35
4853.6	13.26	8.64	5.99	0.37
4853.6	12.92	9.24	6.9	0.45
4853.6	12.83	8.95	6.41	0.44
4853.6	12.79	8.75	5.94	0.45
4848.4	13	8.67	3.32	0.23
4788.4	13.06	8.79	1.26	0.09
4687.6	12.96	8.3	2.68	0.18
4671.1	12.28	8.83	6.53	0.46
4658.8	12.65	8.66	2.31	0.16
4641.3	11.99	8.08	6.42	0.46
4641.3	11.97	8.67	5.65	0.4
4635.4	12.09	8.68	4.15	0.3
4627.8	11.73	8.6	5.52	0.41
4627.8	11.61	8.43	5.46	0.4
4627.8	11.48	8.51	5.71	0.43
4627.8	11.45	8.06	5.28	0.39
4548.7	11.67	8.13	1.99	0.14
4472.9	11.3	7.42	4.88	0.37
4472.9	11.15	7.94	5.07	0.38
4472.9	10.94	7.61	5.56	0.4
4472.9	10.67	7.49	6.25	0.45
4472.9	10.59	7.04	5.94	0.41
4472.9	10.4	7.38	6.32	0.45
4472.9	10.28	6.89	6.48	0.44
4472.9	10.21	6.89	6.38	0.43
4472.9	10.13	6.86	6.04	0.42
4472.9	10.08	6.59	5.32	0.37
4472.9	9.96	6.68	5.49	0.4

4472.9	9.9	6.61	5.31	0.38
4472.9	9.83	6.6	5.28	0.38
4472.9	9.7	6.69	5.59	0.41
4472.9	9.64	6.52	5.45	0.4
4472.9	9.54	6.68	5.53	0.41
4472.9	9.52	6.17	5.11	0.37
4472.9	9.44	6.14	5.19	0.38
4472.9	9.39	6.07	5.19	0.38
4472.9	9.29	6.28	5.4	0.4
4472.9	9.24	5.92	5.23	0.38
4472.9	9.16	6.07	5.41	0.4
4472.9	9.09	5.99	5.44	0.4
4472.9	9.03	5.99	5.39	0.4
4472.9	8.96	5.99	5.38	0.4
4472.9	9.02	4.77	4.37	0.3
4472.9	8.78	5.36	5.53	0.39
4472.9	8.8	5.34	4.97	0.36
4472.9	8.73	5.55	5.13	0.38
4472.9	8.69	5.28	5.17	0.38
4472.9	8.66	5.41	5.03	0.37
4472.9	8.57	5.34	5.23	0.38
4472.9	8.53	5.26	5.15	0.38
4472.9	8.49	5.13	5.18	0.38
4472.9	8.44	5.04	5.11	0.37
4472.9	8.39	5.15	5.19	0.38
4472.9	8.35	5.08	5.08	0.37
4472.9	8.31	5.05	5.04	0.37
4472.9	8.28	5.02	5.03	0.36
4472.9	8.24	4.9	4.99	0.36
4472.9	8.2	4.83	4.98	0.36
4472.9	8.17	4.65	4.84	0.35
4472.9	8.14	4.67	4.84	0.35
4472.9	8.13	4.68	4.52	0.33
4472.9	8.1	4.37	4.52	0.33
4472.9	8.07	4.37	4.5	0.33
4472.9	8.04	4.12	4.46	0.32
4472.9	7.96	3.92	4.73	0.34
4472.9	7.94	3.78	4.68	0.34
4472.9	7.91	3.98	4.54	0.33
4472.9	7.86	3.82	4.67	0.34
4472.9	8	3.76	2.93	0.21

San Francisquito RAS 3.0 Results (Proposed 1958 Conditions with restored levee heights)

Proposed 1958 Conditions WITH WEIR & Q = 6,000 cfs

River Sta (ft)	Thalweg (ft)	Left Levee (ft)	Rt Levee (ft)	Flow (cfs)	Wse (ft)	Crit Wse (ft)	Velocity (ft/s)	Fr Number	dWse
17570	18.64	44.04	42.6	6000	36.89	29.48	6.89	0.34	0
17354	18.26	42.43	43.08	6000	36.75	28.8	6.35	0.34	0
17231	17.44	41.25	40.18	6000	36.21	29.82	7.95	0.43	0
17105	17.2	42.57	40.98	6000	36.16	28.88	7.17	0.37	0
16919	15.78	41.04	41.42	6000	35.96	28.6	7.04	0.36	0
16763	16.97	39.26	41.12	6000	35.64	28.35	7.56	0.38	0
16612	17.74	40.72	40.92	6000	35.64	27.71	6.51	0.32	0
16420	17.46	39.74	40.11	6000	35.41	27.14	6.72	0.33	0
16191	16.24	38.7	38.33	6000	34.43	28.63	9.19	0.47	0.01
15989	16.17	36.88	38.32	6000	34.08	28.24	8.79	0.46	0
15815	16.09	38.09	37.51	6000	33.73	27.39	8.83	0.45	0.01
15641	15.8	37.01	35.91	6000	33.63	26.63	7.74	0.4	0
15348	14.24	37.7	37.36	6000	33.34	25.65	7.19	0.36	0
15100	14.21	36.43	36.99	6000	33.06	25.42	7.16	0.36	0.01
14818	14.18	35.07	35.36	6000	32.74	24.9	7.04	0.37	0
14670	14.1	35.93	33.51	6000	32.75	23.71	5.95	0.3	0
14476	13.18	33.82	34.01	6000	32.65	23.27	5.65	0.29	0
14406	12.4	34.08	34.44	6000	32.25	24.41	7.2	0.34	0
14288	12.76	34.12	33.6	6000	31.47	25.58	9.28	0.48	0.01
14082	11.92	33.17	33.15	6000	30.1	25.76	11.35	0.6	0.01
13872	11.81	32.18	31.6	6000	29.92	24.62	9.14	0.51	0.01
13653	10.78	31.3	33.47	6000	29.88	22.06	7.21	0.36	0.01
13490.3	10.3	32.38	32.73	6000	29.72	21.64	6.93	0.37	0.01
13453.2	11.07	32.77	32.95	6000	29.74	21.29	6.6	0.33	0.02
13444	11.18	32.86	33.44	6000	29.51	21.2	7.52	0.33	0.02
13329	10.97	33.1	32.89	6000	29.11	20.34	7.87	0.34	0.01
13315	10.96	32.2	32.35	6000	29.27	20.48	6.79	0.32	0.01
13302	10.93	31.44	31.89	6000	29.23	20.71	6.9	0.33	0.01
13225	10	31.03	30.4	6000	29.18	20.96	6.69	0.33	0.01
13051	10.26	30.67	30.33	6000	28.8	21.03	7.45	0.37	0.02
12843	10.03	29.55	30.04	6000	28.6	19.99	7.02	0.34	0.01
12627	8.84	30.11	30.07	6000	28.01	20.55	8.1	0.4	0.02
12450	8.2	30	29.46	6000	27.45	20.73	8.81	0.44	0.02
12317.6	9.36	28.27	29.41	6000	27.24	20.52	8.47	0.42	0.02
12173	8.61	30	29.6	6000	27.32	19.55	6.6	0.35	0.02
11991	9.38	29.83	29.36	6000	27.15	18.51	6.37	0.32	0.02
11766	6.77	28.96	28.48	6000	26.44	19.37	8.02	0.42	0.03
11563	6.96	27.94	27.95	6000	25.16	20.02	10.42	0.55	0.04
11370	7.82	27.99	28.52	6000	25.18	18.6	7.95	0.4	0.03
11257.4	6.06	27.92	28.38	6000	24.7	18.94	8.82	0.47	0.05
11231	6.06	27.92	28.38	6000	24.61	18.95	8.9	0.48	0.05
11217	7.74	30.92	30.92	6000	24.37	17.26	9.54	0.42	0.04
11193	7.1	30.87	30.95	6000	24.21	17.11	9.8	0.43	0.04
11155.5	6.77	27.77	27.29	6000	24.68	16.45	6.27	0.31	0.04
10976	6.39	27.42	27.1	6000	23.74	18.2	8.85	0.47	0.05

10716	6.38	26.68	25.71	6000	22.92	17.75	9.2	0.5	0.06
10530	5.45	25.51	26.3	6000	21.63	17.97	10.99	0.61	0.11
10333	5.72	25.06	24.97	6000	21.38	16.43	8.94	0.5	0.13
10143	5.01	24.87	24.58	6000	21.04	15.39	8.17	0.44	0.14
9879	3.4	24.76	24.81	6000	20.33	14.81	8.56	0.47	0.19
9721	4.14	24.75	24.5	6000	19.96	14.24	8.45	0.47	0.21
9529	3.85	24.81	25.35	6000	19.77	13.78	7.58	0.42	0.23
9324	4.28	24.31	24.56	6000	19.41	13.74	7.88	0.42	0.24
9128	3.08	21.64	21.23	6000	18.43	14.58	9.94	0.57	0.35
8973	2.44	20.09	20.14	6000	17.29	14.57	11.7	0.67	0.45
8778	2.54	18.51	19.09	6000	16.63	13.89	11.46	0.66	0.8
8595	2.22	17.58	18.75	6000	16.33	12.8	10.32	0.58	0.92
8390	1.67	18.28	19.24	6000	15.77	12.49	10.28	0.6	0.92
8233	1.82	18.14	18.88	6000	15.8	11.28	8.68	0.48	0.77
8145.3	-0.86	18.1	18.51	6000	15.62	11.17	8.87	0.49	0.64
8057.6	0.84	15.14	17.41	5987.58	15.85	10.25	7	0.37	0.7
8030	1.47	15.52	17.45	5949.34	15.98	9.06	5.89	0.3	0.74
7787	2.3	16.2	15.16	5948.4	14.87	9.19	6.69	0.36	1.2
7779.3	3.19	16.1	15.09	5948.4	14.83	9.42	6.8	0.37	1.19
7700	3	15.52	14.99	5948.4	14.84	9.23	6.18	0.36	1.21
7600	2.55	15.2	15	5948.4	14.8	9.03	5.73	0.33	1.21
7500	2.71	15.31	14.7	5942.35	14.91	9.23	4.31	0.27	1.45
7400	1.73	15.15	14.6	5936.43	14.39	9.36	6.36	0.39	1.13
7300	1.53	15.12	14.5	5936.43	14.02	10.07	7.28	0.46	1.1
7200	1.39	14.5	14.5	5936.42	14.51	9.92	2.27	0.14	1.68
7100	0.9	14.4	14.4	5932.23	14.5	9.51	2.33	0.18	1.71
7000	0.82	14.3	14.3	5931.61	13.81	9.54	6.55	0.44	0.81
6900	0.65	14.2	14.2	5931.61	14.22	9.53	1.25	0.08	1.16
6800	0.9	14.1	14.1	5926.67	14.21	9.28	1.35	0.09	1.25
6700	0.93	14.1	14.1	5926.67	13.39	9.76	6.99	0.47	1.11
6600	0.54	14	14	5926.67	13.26	9.68	6.81	0.47	0.61
6500	0.79	13.9	13.9	5926.67	13.12	9.76	6.87	0.47	1.13
6400	0.46	13.99	13.8	5926.67	13.11	9.43	6.05	0.41	1.14
6300	0.43	13.7	13.7	5926.67	13.01	9.46	5.99	0.41	0.92
6200	0.21	13.7	13.7	5926.67	12.92	9.32	5.83	0.4	1.19
6100	0.04	14.05	13.6	5926.67	12.81	9.15	5.75	0.39	1.2
6000	0.04	14.76	13.5	5926.67	12.7	9.24	5.9	0.42	1.22
5900	-0.04	14.02	13.4	5926.67	12.67	9.08	5.53	0.38	1.22
5800	-0.38	13.99	13.3	5926.67	12.57	8.91	5.52	0.38	0.9
5700	-0.36	13.3	13.3	5926.67	12.48	8.76	5.31	0.36	1.18
5600	-0.38	13.2	13.2	5926.67	12.34	8.73	5.49	0.38	1.19
5500	-0.36	13.1	13.1	5926.67	12.09	8.49	6.12	0.42	1.15
5400	-0.41	13	13	5926.67	11.75	8.51	7.01	0.48	1.08
5300	-0.49	12.9	12.9	5926.67	11.65	8.07	6.73	0.45	1.06
5200	-0.6	12.9	12.9	5926.67	11.42	8.29	7.16	0.48	1.02
5100	-0.6	12.8	12.8	5926.67	11.24	7.86	7.47	0.5	0.96
5000	-0.54	12.7	12.7	5926.67	11.15	7.81	7.4	0.48	0.94
4900	-0.75	12.6	12.6	5926.67	11.06	7.73	6.97	0.46	0.93
4800	-1.02	12.5	12.5	5926.67	11.02	7.35	6.15	0.4	0.94
4700	-0.99	12.5	12.5	5926.67	10.88	7.52	6.28	0.44	0.92
4600	-1.07	12.4	12.4	5926.67	10.82	7.36	6.1	0.41	0.92
4500	-1.05	12.3	12.3	5926.67	10.75	7.35	6.05	0.42	0.92

4400	-0.99	12.2	12.2	5926.67	10.58	7.49	6.4	0.46	0.88
4300	-0.81	12.1	12.1	5926.67	10.5	7.32	6.25	0.45	0.86
4200	-0.89	12.1	12.1	5926.67	10.38	7.42	6.35	0.46	0.84
4100	-1.16	12.36	12	5926.67	10.35	6.97	5.9	0.42	0.83
4000	-1.16	11.9	11.9	5926.67	10.25	6.95	6.01	0.43	0.81
3900	-1.19	11.8	11.8	5926.67	10.17	6.88	6.06	0.42	0.78
3800	-1.03	11.7	11.7	5926.67	10.05	7.04	6.28	0.45	0.76
3700	-1.16	11.7	11.7	5926.67	9.99	6.8	6.14	0.43	0.75
3600	-1.14	11.6	11.6	5926.67	9.87	6.85	6.37	0.45	0.71
3500	-1.08	11.5	11.5	5926.67	9.78	6.78	6.41	0.45	0.69
3400	-1.08	11.4	11.4	5926.67	9.7	6.78	6.36	0.46	0.67
3300	-1.08	11.3	11.3	5926.67	9.61	6.75	6.37	0.46	0.65
3200	-0.99	11.27	12.84	5926.67	9.69	5.64	5.25	0.35	0.67
3100	-0.99	11.71	14.21	5926.67	9.32	6.18	6.74	0.46	0.54
3000	-0.99	11.18	11.54	5926.67	9.36	6.07	6.02	0.42	0.56
2900	-0.99	10.22	11.79	5926.67	9.27	6.3	6.22	0.44	0.54
2800	-0.99	9.92	11.87	5926.67	9.18	6.12	6.3	0.45	0.49
2700	-0.99	9.59	11.57	5926.67	9.14	6.15	6.14	0.44	0.48
2600	-1.08	10.14	11.65	5926.67	9.01	6.11	6.44	0.46	0.44
2500	-1.08	9.56	11.43	5926.67	8.94	6.02	6.37	0.45	0.41
2400	-1.08	10.41	11.9	5926.67	8.87	5.92	6.43	0.46	0.38
2300	-1.08	10.44	11.62	5926.67	8.81	5.82	6.38	0.45	0.37
2200	-1.08	10.44	11.4	5926.67	8.71	5.92	6.52	0.47	0.32
2100	-1.02	9.59	11.43	5926.67	8.64	5.85	6.42	0.46	0.29
2000	-1.02	9.06	11.43	5926.67	8.58	5.81	6.38	0.46	0.27
1900	-1.02	9.39	11.35	5926.67	8.52	5.77	6.41	0.46	0.24
1800	-1.08	9.34	11.32	5926.67	8.45	5.62	6.39	0.45	0.21
1700	-1.07	9.01	11.36	5926.67	8.39	5.57	6.4	0.46	0.19
1600	-1.07	8.96	11.27	5926.67	8.33	5.4	6.25	0.44	0.16
1500	-1.07	9.57	11.49	5926.67	8.26	5.41	6.28	0.45	0.12
1400	-1.07	9.18	11.27	5926.67	8.26	5.41	5.86	0.42	0.13
1300	-1.15	10.14	11.3	5926.67	8.2	5.17	5.9	0.43	0.1
1200	-1.15	9.84	10.78	5926.67	8.14	5.17	5.89	0.42	0.07
1100	-1.18	10.28	10.92	5926.67	8.09	4.91	5.86	0.42	0.05
1000	-1.18	8.96	11.3	5926.67	7.94	4.69	6.28	0.45	-0.02
900	-1.18	9.98	11.34	5926.67	7.89	4.87	6.25	0.46	-0.05
800	-1.18	9.28	10.95	5926.67	7.84	4.76	6.08	0.44	-0.07
700	-1.15	9.07	11.3	5926.67	7.74	4.65	6.31	0.46	-0.12
600	-1.13	7.5	10.42	5926.67	8	4.71	3.88	0.28	0

San Francisquito RAS 3.0 Results (Woodland 2001 Conditions)

Woodland 2001 Conditions NO WEIR & Q = 3,600 cfs

River Sta (ft)	Thalweg (ft)	Left Levee (ft)	Rt Levee (ft)	Flow (cfs)	Wse (ft)	Crit Wse (ft)	Velocity (ft/s)	Fr Number
17570	18.64	44.04	42.6	3600	32.67	27.24	6.06	0.35
17354	18.26	42.43	43.08	3600	32.47	26.51	5.83	0.34
17231	17.44	41.25	40.18	3600	31.95	26.95	7.38	0.43
17105	17.2	42.57	40.98	3600	31.89	26.27	6.51	0.38
16919	15.78	41.04	41.42	3600	31.69	26.15	6.28	0.36
16763	16.97	39.26	41.12	3600	31.39	25.73	6.72	0.38
16612	17.74	40.72	40.92	3600	31.35	25.28	5.71	0.32
16420	17.46	39.74	40.11	3600	31.13	24.73	5.89	0.33
16191	16.24	38.7	38.33	3600	30.27	25.64	8.16	0.47
15989	16.17	36.88	38.32	3600	29.83	25.27	8.04	0.47
15815	16.09	38.09	37.51	3600	29.49	24.58	7.81	0.44
15641	15.8	37.01	35.91	3600	29.32	23.9	6.96	0.4
15348	14.24	37.7	37.36	3600	29	23.13	6.41	0.36
15100	14.21	36.43	36.99	3600	28.66	22.76	6.48	0.37
14818	14.18	35.07	35.36	3600	28.31	22.26	6.46	0.37
14670	14.1	35.93	33.51	3600	28.31	21.38	5.32	0.3
14476	13.18	33.82	34.01	3600	28.2	20.85	5.09	0.28
14406	12.4	34.08	34.44	3600	27.91	22.01	6.23	0.35
14288	12.76	34.12	33.6	3600	27.16	22.51	8.41	0.48
14082	11.92	33.17	33.15	3600	25.84	22.95	10.42	0.59
13872	11.81	32.18	31.6	3600	25.41	21.15	8.92	0.54
13653	10.78	31.3	33.47	3600	25.38	19.41	6.51	0.37
13490.3	10.3	32.38	32.73	3600	25.17	19.02	6.47	0.37
13453.2	11.07	32.77	32.95	3600	25.21	18.83	5.91	0.33
13444	11.18	32.86	33.44	3600	25.14	18.83	6.22	0.32
13329	10.97	33.1	32.89	3600	25.02	17.98	6.22	0.31
13315	10.96	32.2	32.35	3600	25.07	18.04	5.73	0.3
13302	10.93	31.44	31.89	3600	25.02	18.16	5.88	0.32
13225	10	31.03	30.4	3600	24.96	18.44	5.8	0.32
13051	10.26	30.67	30.33	3600	24.62	18.38	6.45	0.36
12843	10.03	29.55	30.04	3600	24.45	17.46	5.89	0.31
12627	8.84	30.11	30.07	3600	23.94	17.73	6.91	0.38
12450	8.2	30	29.46	3600	23.47	17.76	7.5	0.41
12317.6	9.36	28.27	29.41	3600	23.25	17.61	7.25	0.41
12173	8.61	30	29.6	3600	23.16	16.83	6.17	0.37
11991	9.38	29.83	29.36	3600	23.03	16.17	5.49	0.3
11766	6.77	28.96	28.48	3600	22.4	16.49	7.05	0.4
11563	6.96	27.94	27.95	3600	21.42	16.83	8.88	0.5
11370	7.82	27.99	28.52	3600	21.32	15.89	6.86	0.4
11257.4	6.06	27.92	28.38	3600	20.84	15.83	7.83	0.46
11231	6.06	27.92	28.38	3600	20.76	15.83	7.91	0.47
11217	7.74	30.92	30.92	3600	20.83	14.66	7.33	0.36
11193	7.1	30.87	30.95	3600	20.75	14.41	7.45	0.37
11155.5	6.77	27.77	27.29	3600	20.97	14.24	5.17	0.28
10976	6.39	27.42	27.1	3600	20.19	15.39	7.59	0.45

10716	6.38	26.68	25.71		3600	19.39	14.7	8.03	0.48
10530	5.45	25.51	26.3		3600	18.3	15.01	9.48	0.57
10333	5.72	25.06	24.97		3600	17.91	13.47	7.91	0.49
10143	5.01	24.87	24.58		3600	17.56	12.91	7.09	0.43
9879	3.4	24.76	24.81		3600	16.93	12.13	7.31	0.43
9721	4.14	24.75	24.5		3600	16.63	11.76	7.11	0.41
9529	3.85	24.81	25.35		3600	16.41	11.34	6.52	0.4
9324	4.28	24.06	24.56		3600	16.13	11.54	6.62	0.39
9128	3.08	21.62	21.23		3600	15.31	11.89	8.52	0.53
8973	2.44	20.09	20.14		3600	14.52	11.77	9.66	0.61
8778	2.54	18.51	19.09		3600	13.97	11.1	9.41	0.59
8595	2.22	17.58	18.75		3600	13.69	10.21	8.38	0.52
8390	1.67	18.28	19.24		3600	13.2	9.93	8.43	0.54
8233	1.82	18.14	18.88		3600	13.2	8.93	6.96	0.43
8145.3	-0.86	18.1	18.51		3600	13.09	8.79	7.04	0.43
8057.6	0.84	15.14	17.41		3600	13.21	8.38	5.54	0.34
8030	1.47	15.52	17.45		3600	13.29	7.51	4.56	0.26
7787	2.3	16.2	15.16		3600	12.72	7.59	5.01	0.29
7779.3	3.19	16.1	15.09		3600	12.7	7.82	5.13	0.3
7700	3	15.52	14.99		3600	12.68	7.55	4.81	0.3
7600	2.55	15.2	15		3600	12.65	7.43	4.47	0.28
7500	2.71	15.31	13.98		3600	12.56	7.58	4.62	0.3
7400	1.73	15.15	13.96		3600	12.42	7.72	4.95	0.32
7300	1.53	15.12	13.58		3600	12.19	8.09	5.68	0.39
7200	1.39	13.39	13.61		3600	12.12	7.57	5.31	0.38
7100	0.9	14.02	13.14		3600	12.09	7.45	4.93	0.34
7000	0.82	13.36	12.78		3600	11.96	7.47	5.29	0.37
6900	0.65	12.86	12.61		3600	11.83	7.62	4.99	0.36
6800	0.9	13.36	12.45		3600	11.69	7.41	4.92	0.34
6700	0.93	13.47	12.97		3600	11.41	7.92	5.8	0.42
6600	0.54	13.25	12.2		3600	11.31	7.1	5.65	0.42
6500	0.79	13.39	12.48		3600	11.2	6.99	5.69	0.42
6400	0.46	13.99	12.56		3600	11.18	6.94	5.03	0.38
6300	0.43	13.41	11.81		3600	11.08	7.94	5.04	0.39
6200	0.21	13.36	12.12		3600	10.99	7.94	4.91	0.38
6100	0.04	14.05	12.28		3600	10.89	7.78	4.84	0.37
6000	0.04	14.76	12.15		3600	10.78	7.86	5.09	0.4
5900	-0.04	14.02	11.7		3600	10.75	6.34	4.69	0.37
5800	-0.38	13.99	10.7		3600	10.65	7.29	4.66	0.36
5700	-0.36	11.65	11.41		3600	10.55	6.1	4.52	0.36
5600	-0.38	12	11.25		3600	10.41	7.1	4.7	0.37
5500	-0.36	12.45	11.6		3600	10.24	6.91	5.06	0.38
5400	-0.41	12.4	12.05		3600	10.02	6.08	5.63	0.42
5300	-0.49	12.05	11.84		3600	9.96	5.71	5.3	0.38
5200	-0.6	11.63	12.02		3600	9.8	6.55	5.63	0.41
5100	-0.6	12	12.08		3600	9.72	5.88	5.67	0.4
5000	-0.54	12.08	11.97		3600	9.66	5.91	5.59	0.39
4900	-0.75	10.9	11.86		3600	9.6	5.75	5.28	0.38
4800	-1.02	11.23	11.55		3600	9.56	5.36	4.65	0.33
4700	-0.99	11.04	10.91		3600	9.45	5.15	4.82	0.36
4600	-1.07	11.57	11.2		3600	9.41	5.16	4.64	0.34
4500	-1.05	11.07	11.09		3600	9.35	5.55	4.62	0.34

4400	-0.99	11.31	10.67		3600	9.25	5.27	4.88	0.37
4300	-0.81	10.91	10.59		3600	9.18	4.98	4.76	0.36
4200	-0.89	11.78	10.46		3600	9.11	5.99	4.82	0.37
4100	-1.16	12.36	10.37		3600	9.09	5.51	4.43	0.33
4000	-1.16	11.22	10.29		3600	9.03	5.48	4.49	0.34
3900	-1.19	11.3	10.23		3600	8.99	5.43	4.48	0.33
3800	-1.03	10.5	10.5		3600	8.91	5.73	4.65	0.36
3700	-1.16	10.77	10.5		3600	8.87	5.36	4.5	0.34
3600	-1.14	11.03	10.31		3600	8.8	5.41	4.63	0.35
3500	-1.08	10.05	10.42		3600	8.75	5.32	4.65	0.35
3400	-1.08	9.97	10.08		3600	8.71	5.28	4.6	0.35
3300	-1.08	10.05	10.14		3600	8.66	5.37	4.58	0.35
3200	-0.99	11.27	12.84		3600	8.7	3.65	3.7	0.26
3100	-0.99	11.71	14.21		3600	8.53	4.83	4.63	0.33
3000	-0.99	11.18	11.54		3600	8.55	4.82	4.17	0.3
2900	-0.99	10.22	11.79		3600	8.5	5	4.3	0.32
2800	-0.99	9.92	11.87		3600	8.47	4.7	4.32	0.32
2700	-0.99	9.59	11.57		3600	8.44	4.78	4.21	0.31
2600	-1.08	10.14	11.65		3600	8.39	4.71	4.35	0.32
2500	-1.08	9.56	11.43		3600	8.36	4.75	4.27	0.32
2400	-1.08	10.41	11.9		3600	8.32	4.6	4.29	0.32
2300	-1.08	10.44	11.62		3600	8.29	4.51	4.22	0.31
2200	-1.08	10.44	11.4		3600	8.25	4.64	4.28	0.31
2100	-1.02	9.59	11.43		3600	8.23	4.56	4.18	0.31
2000	-1.02	9.06	11.43		3600	8.21	4.48	4.12	0.3
1900	-1.02	9.39	11.35		3600	8.19	4.5	4.11	0.3
1800	-1.08	9.34	11.32		3600	8.17	4.37	4.06	0.29
1700	-1.07	9.01	11.36		3600	8.15	4.32	4.04	0.29
1600	-1.07	8.96	11.27		3600	8.13	4.13	3.92	0.28
1500	-1.07	9.57	11.49		3600	8.11	4.17	3.91	0.28
1400	-1.07	9.18	11.27		3600	8.1	4.17	3.65	0.27
1300	-1.15	10.14	11.3		3600	8.08	3.49	3.65	0.27
1200	-1.15	9.84	10.78		3600	8.05	3.46	3.64	0.26
1100	-1.18	10.28	10.92		3600	8.03	3.16	3.6	0.26
1000	-1.18	8.96	11.3		3600	7.99	3.18	3.79	0.27
900	-1.18	9.98	11.34		3600	7.97	3.08	3.75	0.27
800	-1.18	9.28	10.95		3600	7.95	3.13	3.63	0.26
700	-1.15	9.07	11.3		3600	7.91	3.13	3.72	0.27
600	-1.13	7.5	10.42		3600	8	3.13	2.35	0.17

NO WEIR & Q = 6,000 cfs					WITH WEIR & Q = 3,600 cfs				
Flow (cfs)	Wse (ft)	Crit Wse (ft)	Velocity (ft/s)	Fr Number	Flow (cfs)	Wse (ft)	Crit Wse (ft)	Velocity (ft/s)	Fr Number
6000	36.89	29.48	6.89	0.34	3600	32.71	27.21	6.04	0.35
6000	36.75	28.8	6.35	0.34	3600	32.52	26.46	5.8	0.34
6000	36.21	29.82	7.95	0.43	3600	32.01	26.92	7.34	0.43
6000	36.16	28.88	7.17	0.37	3600	31.94	26.28	6.48	0.38
6000	35.96	28.6	7.04	0.36	3600	31.71	26.12	6.26	0.36
6000	35.64	28.35	7.56	0.38	3600	31.41	25.7	6.71	0.38
6000	35.64	27.71	6.51	0.32	3600	31.38	25.25	5.7	0.32
6000	35.41	27.14	6.72	0.33	3600	31.16	24.7	5.87	0.33
6000	34.43	28.63	9.19	0.47	3600	30.3	25.64	8.13	0.47
6000	34.08	28.24	8.79	0.46	3600	29.91	25.24	7.97	0.47
6000	33.72	27.39	8.83	0.45	3600	29.58	24.55	7.74	0.44
6000	33.63	26.63	7.75	0.4	3600	29.41	23.87	6.89	0.4
6000	33.34	25.65	7.19	0.36	3600	29.07	23.1	6.37	0.36
6000	33.06	25.42	7.16	0.36	3600	28.72	22.73	6.44	0.37
6000	32.74	24.9	7.04	0.37	3600	28.37	22.27	6.42	0.36
6000	32.75	23.71	5.95	0.3	3600	28.34	21.35	5.31	0.29
6000	32.65	23.27	5.66	0.29	3600	28.22	20.82	5.07	0.28
6000	32.25	24.41	7.2	0.34	3600	27.94	22.01	6.21	0.34
6000	31.46	25.58	9.28	0.48	3600	27.19	22.5	8.38	0.48
6000	30.09	25.76	11.35	0.6	3600	25.87	22.88	10.39	0.59
6000	29.92	24.62	9.14	0.51	3600	25.45	21.08	8.89	0.53
6000	29.87	22.06	7.22	0.36	3600	25.41	19.42	6.49	0.37
6000	29.71	21.64	6.93	0.37	3600	25.21	19.04	6.44	0.37
6000	29.73	21.29	6.6	0.33	3600	25.21	18.83	5.9	0.33
6000	29.5	21.2	7.53	0.33	3600	25.15	18.82	6.21	0.32
6000	29.11	20.34	7.87	0.34	3600	25.05	17.99	6.21	0.3
6000	29.27	20.48	6.8	0.32	3600	25.06	18.06	5.74	0.31
6000	29.22	20.71	6.9	0.33	3600	24.99	18.18	5.9	0.32
6000	29.17	20.96	6.69	0.33	3600	24.93	18.41	5.81	0.32
6000	28.79	21.03	7.46	0.37	3600	24.59	18.38	6.47	0.36
6000	28.6	19.99	7.02	0.34	3600	24.42	17.42	5.91	0.31
6000	28	20.55	8.11	0.4	3600	23.95	17.69	6.9	0.38
6000	27.44	20.73	8.82	0.44	3600	23.47	17.73	7.5	0.41
6000	27.22	20.52	8.48	0.42	3600	23.28	17.61	7.22	0.4
6000	27.31	19.55	6.61	0.35	3600	23.15	16.8	6.17	0.37
6000	27.14	18.51	6.37	0.32	3600	23.02	16.14	5.49	0.3
6000	26.42	19.37	8.03	0.42	3600	22.39	16.5	7.06	0.4
6000	25.14	20.02	10.44	0.55	3600	21.41	16.79	8.89	0.5
6000	25.16	18.6	7.96	0.41	3600	21.31	15.86	6.87	0.4
6000	24.67	18.94	8.84	0.48	3600	20.83	15.83	7.85	0.46
6000	24.58	18.95	8.92	0.48	3600	20.75	15.83	7.92	0.47
6000	24.35	17.26	9.55	0.42	3600	20.82	14.63	7.34	0.36
6000	24.18	17.11	9.81	0.43	3600	20.73	14.42	7.46	0.37
6000	24.66	16.45	6.28	0.31	3600	20.96	14.2	5.18	0.29
6000	23.71	18.2	8.87	0.47	3600	20.16	15.37	7.62	0.45

6000	22.89	17.75	9.23	0.5	3600	19.36	14.67	8.05	0.48
6000	21.58	17.97	11.05	0.61	3600	18.26	14.97	9.52	0.57
6000	21.31	16.43	9	0.5	3600	17.91	13.48	7.9	0.49
6000	20.97	15.39	8.23	0.44	3600	17.56	12.88	7.08	0.43
6000	20.23	14.81	8.65	0.47	3600	16.94	12.11	7.3	0.43
6000	19.85	14.24	8.54	0.48	3600	16.66	11.74	7.08	0.41
6000	19.65	13.78	7.67	0.42	3600	16.43	11.31	6.5	0.4
6000	19.29	13.74	7.97	0.43	3600	16.15	11.51	6.6	0.39
6000	18.25	14.58	10.13	0.58	3600	15.4	11.85	8.42	0.53
6000	17	14.57	12.07	0.7	3600	14.66	11.77	9.5	0.59
6000	16.22	13.89	11.99	0.7	3600	14.14	11.07	9.2	0.58
6000	15.84	12.8	10.87	0.63	3600	13.89	10.19	8.17	0.51
6000	15.01	12.49	11.2	0.68	3600	13.44	9.91	8.16	0.52
6000	15.03	11.28	9.4	0.54	3600	13.4	8.94	6.79	0.41
6000	14.79	11.17	9.66	0.56	3600	13.29	8.77	6.87	0.42
6000	15.06	10.26	7.56	0.42	3600	13.38	8.4	5.43	0.33
6000	15.2	9.09	6.35	0.33	3600	13.43	7.52	4.5	0.25
6000	14.13	9.23	7.23	0.39	3600	12.85	7.61	4.94	0.29
6000	14.08	9.45	7.38	0.41	3600	12.79	7.82	5.07	0.3
6000	14.08	9.27	6.78	0.4	3600	12.73	7.53	4.78	0.3
6000	14.03	9.05	6.3	0.38	3600	12.67	7.44	4.46	0.28
6000	14.08	9.27	5.34	0.34	3600	12.55	7.56	4.63	0.3
6000	14	9.4	5.2	0.33	3600	12.38	7.7	4.98	0.32
6000	13.61	10.12	6.62	0.42	3600	12.14	8.06	5.73	0.39
6000	13.1	9.97	7.61	0.51	3600	12.07	7.54	5.35	0.38
6000	13.24	9.56	6.12	0.5	3600	12	7.45	5	0.35
6000	13.54	9.59	1.68	0.12	3600	11.87	7.45	5.37	0.38
6000	13.53	9.58	1.44	0.1	3600	11.73	7.58	5.07	0.36
6000	13.52	9.32	1.56	0.1	3600	11.59	7.39	5	0.35
6000	12.36	9.81	8.28	0.58	3600	11.29	7.89	5.92	0.43
6000	12.98	9.74	2.75	0.19	3600	11.21	7.07	5.75	0.43
6000	12.65	9.81	5.49	0.38	3600	11.13	6.98	5.76	0.43
6000	12.66	9.46	4.41	0.3	3600	11.05	6.96	5.15	0.39
6000	12.55	9.5	4.73	0.33	3600	10.97	7.95	5.15	0.4
6000	12.45	9.35	4.83	0.34	3600	10.89	7.92	5	0.39
6000	12.41	9.19	4.43	0.31	3600	10.81	7.73	4.92	0.38
6000	12.35	9.28	4.59	0.34	3600	10.73	7.82	5.13	0.41
6000	12.37	9.12	3.69	0.26	3600	10.7	6.34	4.73	0.37
6000	12.4	8.95	2.3	0.16	3598.72	10.87	7.25	1.86	0.14
6000	12.43	8.79	1.19	0.08	3597.19	10.6	6.05	4.47	0.35
6000	12.43	8.77	1.15	0.08	3597.19	10.45	7.12	4.66	0.37
6000	12.38	8.53	1.7	0.12	3597.19	10.29	6.91	5.01	0.38
6000	11.49	8.55	7.38	0.5	3597.19	10.13	6.05	5.51	0.41
6000	12.01	8.12	1.86	0.13	3597.19	10.05	5.68	5.22	0.37
6000	12.03	8.33	1.17	0.08	3597.19	9.92	6.55	5.5	0.4
6000	11	7.91	7.83	0.53	3597.19	9.84	5.87	5.57	0.39
6000	10.9	7.85	7.76	0.51	3597.19	9.76	5.92	5.5	0.38
6000	11.44	7.77	2.29	0.15	3597.19	9.68	5.79	5.21	0.37
6000	10.79	7.39	6.43	0.43	3597.19	9.6	5.26	4.62	0.33
6000	11.2	7.56	1.34	0.09	3597.19	9.52	5.15	4.76	0.35
6000	10.5	7.4	6.48	0.44	3597.19	9.43	5.04	4.62	0.34
6000	10.41	7.39	6.45	0.45	3597.19	9.35	5.52	4.62	0.34

6000	10.75	7.53	2.87	0.2	3597.19	9.27	5.26	4.85	0.37
6000	10.75	7.35	2.39	0.17	3597.19	9.22	4.94	4.72	0.36
6000	10.71	7.46	2.76	0.2	3597.19	9.18	6.05	4.75	0.36
6000	10.7	7.01	2.74	0.19	3597.19	9.13	5.51	4.39	0.33
6000	10.71	6.99	2.03	0.14	3597.19	9.09	5.48	4.44	0.33
6000	10.71	6.91	1.85	0.13	3597.19	9.04	5.43	4.43	0.33
6000	10.72	7.08	1.4	0.1	3597.19	8.99	5.7	4.58	0.35
6000	10.1	6.84	6.11	0.42	3597.19	8.95	5.32	4.43	0.33
6000	10.45	6.89	1.95	0.14	3597.19	8.9	5.39	4.55	0.34
6000	9.76	6.81	6.51	0.46	3597.19	8.89	5.32	4.53	0.34
6000	10.16	6.81	2.15	0.16	3597.19	8.88	5.31	4.45	0.33
6000	10.16	6.78	1.95	0.14	3597.19	8.86	5.38	4.4	0.33
6000	9.71	5.67	5.29	0.35	3597.19	8.85	3.62	3.61	0.25
6000	9.34	6.22	6.81	0.46	3597.19	8.74	4.82	4.48	0.31
6000	9.38	6.11	6.08	0.42	3597.19	8.71	4.83	4.06	0.29
6000	9.29	6.34	6.27	0.45	3597.19	8.67	4.99	4.17	0.31
6000	9.2	6.16	6.36	0.46	3597.19	8.64	4.7	4.2	0.31
6000	9.17	6.18	6.19	0.44	3597.19	8.6	4.76	4.08	0.3
6000	9.03	6.15	6.5	0.46	3597.19	8.57	4.78	4.21	0.31
6000	8.97	6.06	6.42	0.46	3597.19	8.53	4.71	4.14	0.3
6000	8.89	5.96	6.48	0.46	3597.19	8.5	4.59	4.15	0.3
6000	8.83	5.86	6.43	0.45	3597.19	8.46	4.5	4.09	0.29
6000	8.73	5.96	6.58	0.47	3597.19	8.43	4.6	4.15	0.3
6000	8.66	5.89	6.48	0.46	3597.19	8.39	4.53	4.06	0.29
6000	8.6	5.85	6.45	0.46	3597.19	8.36	4.47	4.02	0.29
6000	8.53	5.8	6.47	0.46	3597.19	8.33	4.49	4.01	0.29
6000	8.46	5.65	6.45	0.46	3597.19	8.29	4.37	3.98	0.29
6000	8.4	5.61	6.47	0.46	3597.19	8.26	4.29	3.97	0.29
6000	8.34	5.44	6.32	0.45	3597.19	8.22	4.11	3.86	0.28
6000	8.27	5.45	6.35	0.45	3597.19	8.19	4.16	3.86	0.28
6000	8.26	5.44	5.92	0.43	3597.19	8.15	4.13	3.62	0.26
6000	8.2	5.2	5.96	0.43	3597.19	8.12	3.49	3.63	0.26
6000	8.15	5.2	5.96	0.43	3597.19	8.08	3.39	3.61	0.26
6000	8.1	4.94	5.93	0.42	3597.19	8.05	3.15	3.58	0.26
6000	7.94	4.73	6.36	0.45	3597.19	8.01	3.18	3.77	0.27
6000	7.89	4.91	6.33	0.46	3597.19	7.98	3.06	3.73	0.27
6000	7.84	4.8	6.16	0.45	3597.19	7.95	3.13	3.63	0.26
6000	7.73	4.68	6.4	0.46	3597.19	7.91	3.13	3.72	0.27
6000	8	4.76	3.92	0.28	3597.19	8	3.13	2.35	0.17

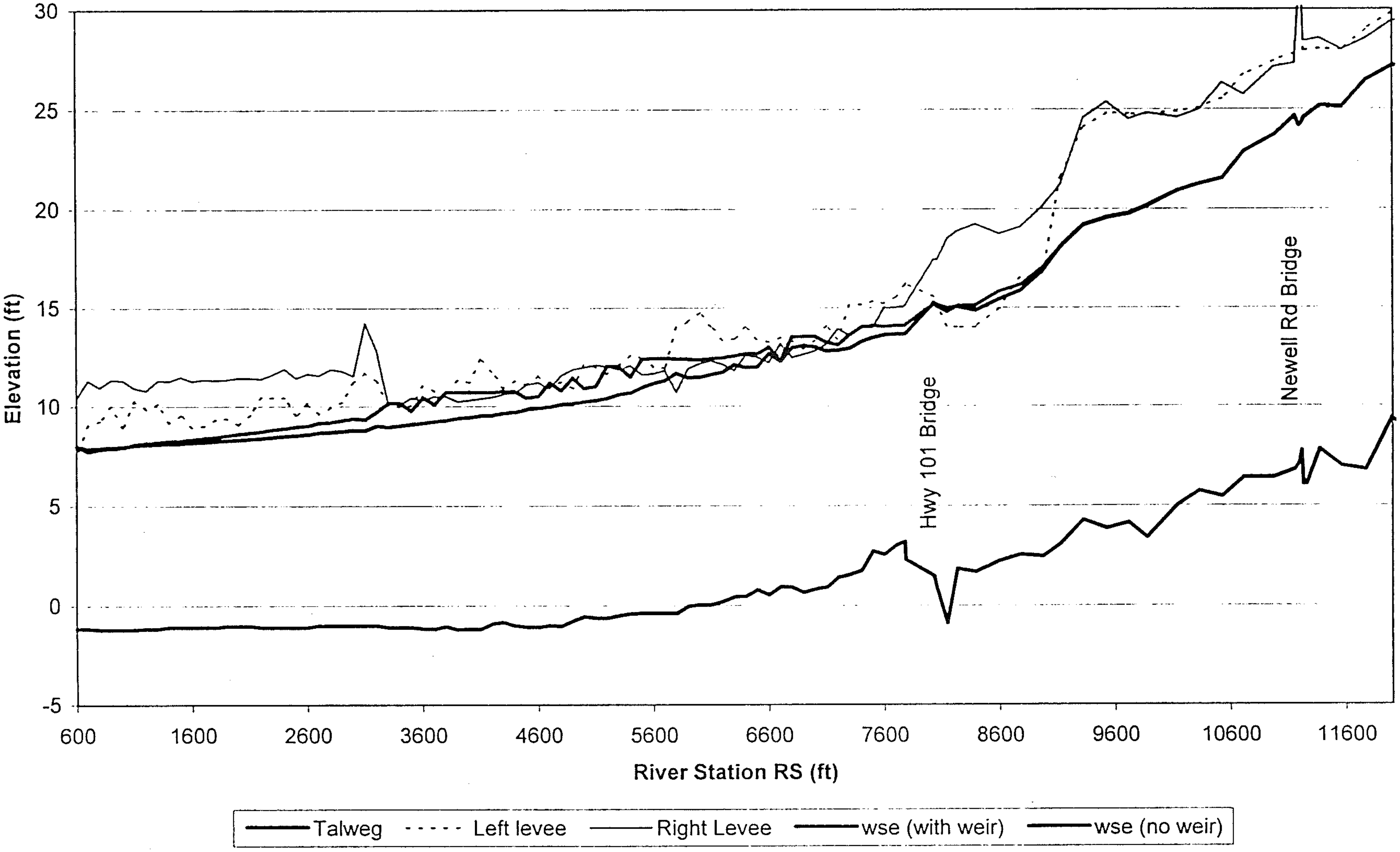
WITH WEIR & Q = 6,000 cfs

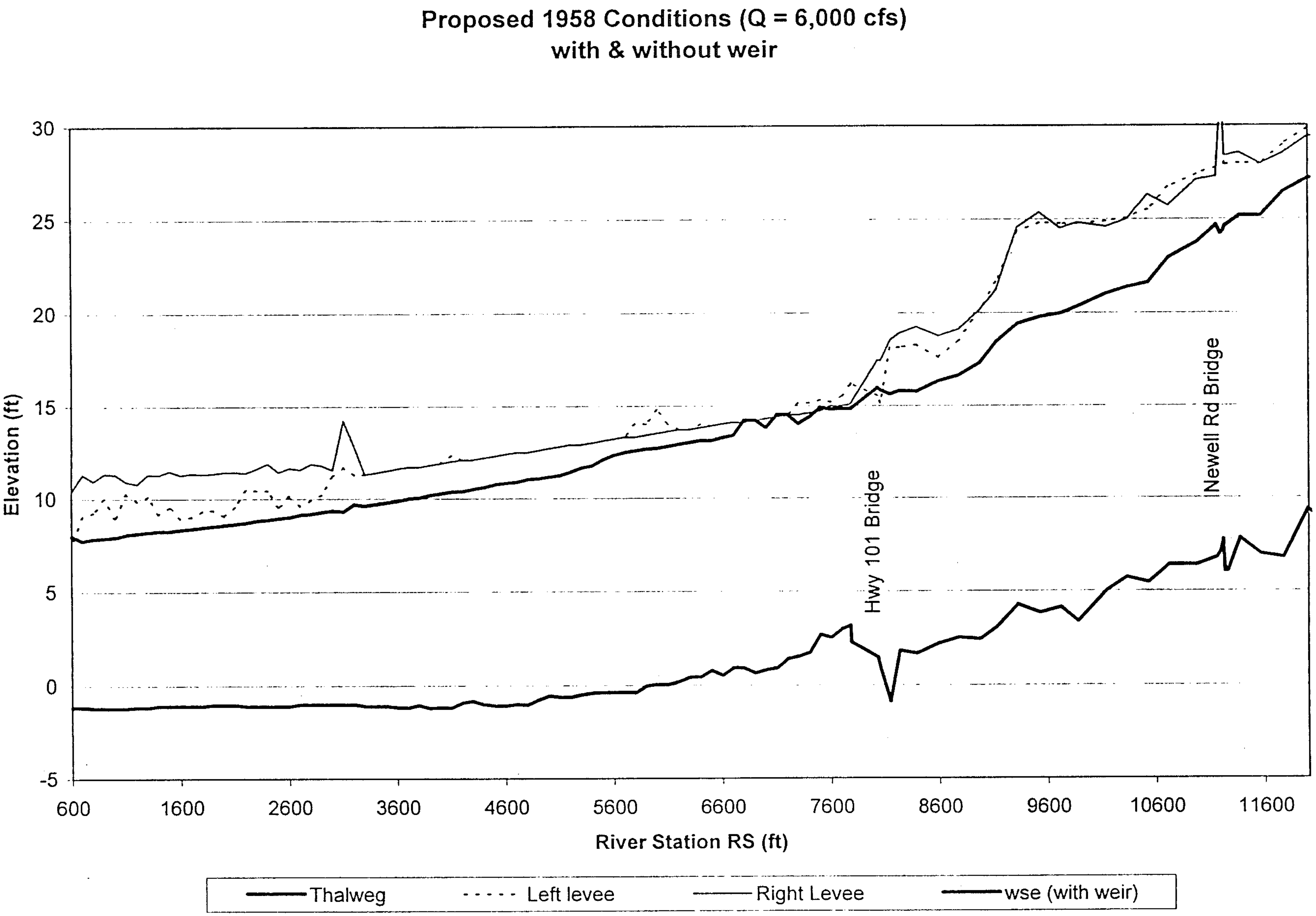
Flow (cfs)	Wse (ft)	Crit Wse (ft)	Velocity (ft/s)	Fr Number	dWse
6000	36.97	29.43	6.84	0.34	0.08
6000	36.84	28.77	6.3	0.33	0.09
6000	36.31	29.78	7.88	0.42	0.1
6000	36.26	28.84	7.11	0.37	0.1
6000	36.02	28.58	7.01	0.36	0.06
6000	35.71	28.33	7.52	0.38	0.07
6000	35.71	27.67	6.48	0.31	0.07
6000	35.48	27.1	6.69	0.33	0.07
6000	34.51	28.58	9.12	0.47	0.09
6000	34.16	28.2	8.73	0.45	0.08
6000	33.81	27.36	8.76	0.44	0.09
6000	33.72	26.59	7.68	0.39	0.09
6000	33.41	25.61	7.15	0.36	0.07
6000	33.09	25.39	7.13	0.36	0.04
6000	32.78	24.91	7.02	0.37	0.04
6000	32.75	23.69	5.95	0.3	0
6000	32.65	23.22	5.65	0.29	0
6000	32.25	24.42	7.2	0.34	0
6000	31.47	25.54	9.28	0.48	0.01
6000	30.06	25.68	11.39	0.6	-0.03
6000	29.92	24.59	9.14	0.51	0.01
6000	29.83	22.1	7.24	0.37	-0.04
6000	29.67	21.65	6.96	0.37	-0.04
6000	29.68	21.28	6.63	0.33	-0.04
6000	29.45	21.19	7.55	0.33	-0.04
6000	29.07	20.35	7.89	0.34	-0.03
6000	29.22	20.5	6.82	0.32	-0.04
6000	29.17	20.68	6.93	0.34	-0.05
6000	29.12	20.93	6.72	0.33	-0.05
6000	28.73	21	7.49	0.37	-0.05
6000	28.54	19.94	7.05	0.34	-0.05
6000	27.98	20.51	8.12	0.4	-0.01
6000	27.42	20.75	8.83	0.44	-0.01
6000	27.2	20.49	8.5	0.42	-0.02
6000	27.29	19.51	6.62	0.35	-0.01
6000	27.12	18.47	6.38	0.32	-0.01
6000	26.39	19.31	8.05	0.42	-0.02
6000	25.07	19.99	10.5	0.55	-0.05
6000	25.09	18.55	8.01	0.41	-0.06
6000	24.6	18.91	8.91	0.48	-0.05
6000	24.47	18.9	9.02	0.49	-0.09
6000	24.29	17.23	9.58	0.42	-0.04
6000	24.13	17.07	9.84	0.43	-0.04
6000	24.61	16.4	6.31	0.31	-0.03
6000	23.72	18.16	8.87	0.47	0.03

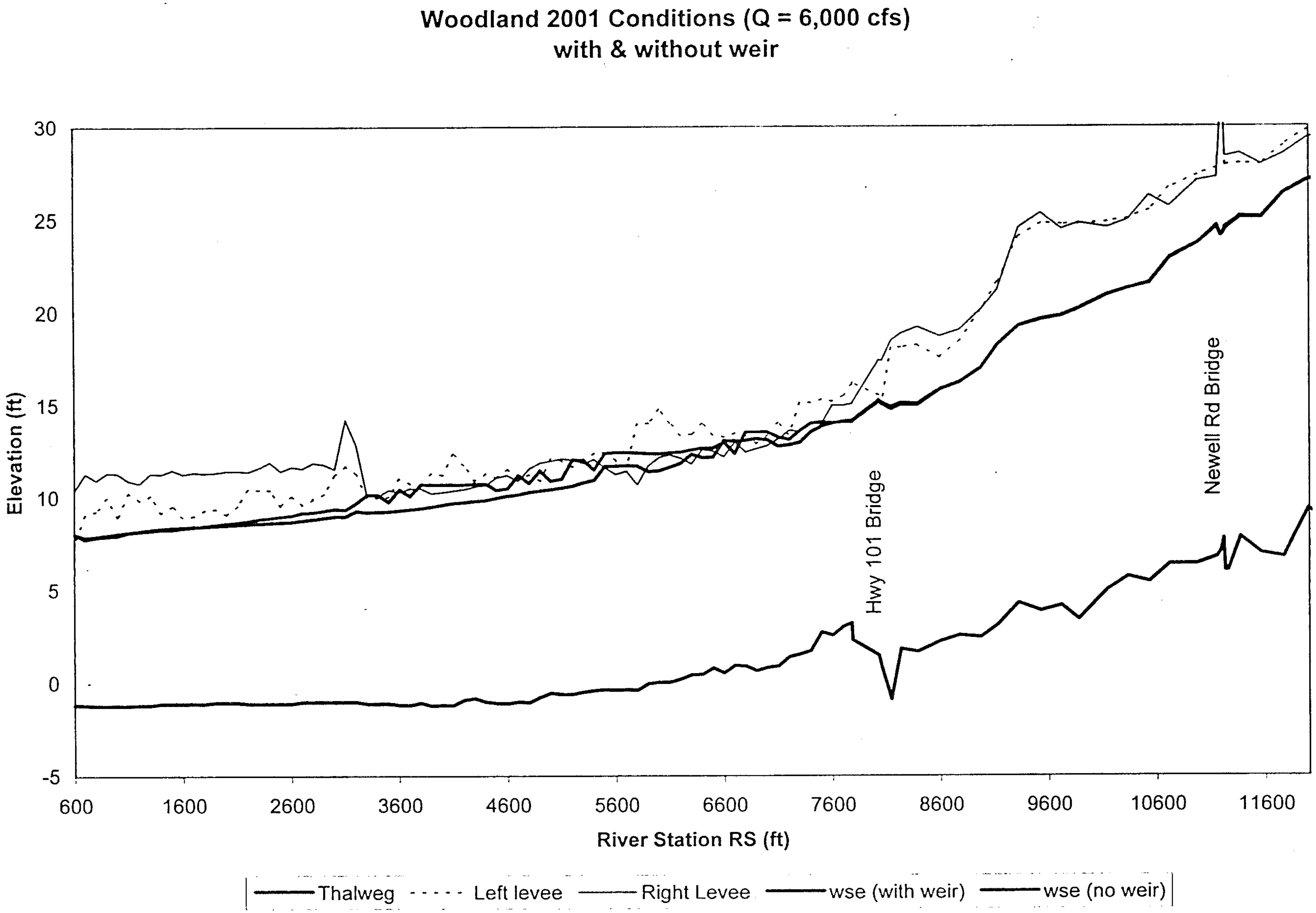
6000	22.92	17.71	9.21	0.5	0.06
6000	21.6	17.91	11.03	0.61	0.08
6000	21.3	16.41	9.01	0.51	0.05
6000	20.96	15.35	8.23	0.44	0.06
6000	20.21	14.8	8.66	0.47	0.07
6000	19.83	14.22	8.56	0.48	0.08
6000	19.63	13.74	7.68	0.42	0.09
6000	19.29	13.7	7.97	0.43	0.12
6000	18.25	14.54	10.13	0.58	0.17
6000	17	14.53	12.06	0.7	0.16
6000	16.23	13.86	11.98	0.7	0.4
6000	15.85	12.81	10.85	0.63	0.44
6000	15.09	12.47	11.1	0.67	0.24
6000	15.12	11.24	9.32	0.54	0.09
6000	14.91	11.14	9.54	0.55	-0.07
6000	15.12	10.22	7.52	0.41	-0.03
6000	15.26	9.09	6.32	0.33	0.02
6000	14.18	9.23	7.19	0.39	0.51
6000	14.15	9.45	7.33	0.41	0.51
6000	14.11	9.28	6.76	0.4	0.48
6000	14.01	9.06	6.31	0.38	0.42
6000	13.83	9.29	6.51	0.42	0.37
6000	13.51	9.4	7.19	0.44	0.25
6000	12.95	10.11	8.49	0.56	0.03
6000	12.81	9.97	7.94	0.54	-0.02
6000	12.75	9.57	7.4	0.55	-0.04
5990.78	13.09	9.59	3.99	0.28	0.09
5904.67	13.16	9.49	1.52	0.11	0.1
5771.62	13.06	9.14	3.21	0.22	0.1
5706.79	13.04	9.59	3.5	0.24	0.76
5604.26	13.05	9.43	2.53	0.17	0.4
5535.44	12.16	9.54	7.44	0.53	0.17
5535.44	12.14	9.17	6.56	0.46	0.17
5511.21	12.32	9.22	4.62	0.33	0.23
5396.11	11.83	8.99	6.32	0.46	0.1
5396.11	11.63	8.9	6.34	0.47	0.02
5396.11	11.43	8.94	6.72	0.51	-0.05
5396.11	11.39	8.85	6.23	0.47	-0.06
5303.28	11.7	8.54	2.3	0.17	0.03
5137.59	11.72	8.38	1.08	0.08	0.42
5071.71	11.69	8.26	1.67	0.12	0.54
5030.76	11.68	7.94	1.58	0.11	0.74
5030.57	10.94	7.91	6.74	0.47	0.27
5030.57	10.81	7.44	6.47	0.44	0.22
5030.57	10.63	7.7	6.85	0.48	0.23
5030.57	10.52	7.28	7.04	0.47	0.24
5030.57	10.44	7.27	6.94	0.47	0.23
5030.57	10.37	7.2	6.55	0.45	0.24
5030.57	10.29	6.93	5.79	0.4	0.21
5030.57	10.17	6.99	5.96	0.42	0.21
5030.57	10.09	6.93	5.79	0.41	0.19
5030.57	9.98	6.87	5.8	0.42	0.15

	5030.57	9.86	6.96	6.11	0.44	0.16
	5030.57	9.81	6.81	5.95	0.43	0.17
	5030.57	9.75	6.93	5.99	0.44	0.21
	5030.57	9.7	6.5	5.57	0.4	0.18
	5030.57	9.61	6.49	5.68	0.41	0.17
	5030.57	9.51	6.36	5.72	0.41	0.12
	5030.57	9.42	6.54	5.93	0.44	0.13
	5030.57	9.36	6.25	5.77	0.42	0.12
	5030.57	9.3	6.35	5.93	0.43	0.14
	5030.57	9.24	6.26	5.96	0.44	0.15
	5030.57	9.22	6.33	5.86	0.43	0.19
	5030.57	9.2	6.25	5.8	0.43	0.24
	5030.57	9.27	5.19	4.73	0.32	0.25
	5030.57	8.98	5.7	6.03	0.42	0.2
	5030.57	8.97	5.6	5.44	0.38	0.17
	5030.57	8.89	5.81	5.61	0.41	0.16
	5030.57	8.82	5.59	5.68	0.42	0.13
	5030.57	8.75	5.67	5.57	0.41	0.09
	5030.57	8.68	5.65	5.78	0.42	0.11
	5030.57	8.65	5.52	5.68	0.41	0.12
	5030.57	8.62	5.42	5.69	0.41	0.13
	5030.57	8.59	5.32	5.61	0.4	0.15
	5030.57	8.56	5.42	5.67	0.41	0.17
	5030.57	8.53	5.35	5.55	0.4	0.18
	5030.57	8.5	5.32	5.49	0.39	0.19
	5030.57	8.47	5.29	5.48	0.39	0.19
	5030.57	8.44	5.15	5.43	0.39	0.2
	5030.57	8.42	5.09	5.41	0.38	0.22
	5030.57	8.39	4.92	5.26	0.37	0.22
	5030.57	8.36	4.94	5.25	0.37	0.22
	5030.57	8.33	4.95	4.91	0.35	0.2
	5030.57	8.26	4.65	4.95	0.36	0.16
	5030.57	8.18	4.71	4.97	0.36	0.11
	5030.57	8.11	4.41	4.96	0.35	0.07
	5030.57	8.04	4.23	5.25	0.37	0.08
	5030.57	7.96	4.36	5.24	0.38	0.02
	5030.57	7.89	4.28	5.12	0.37	-0.02
	5030.57	7.82	4.16	5.28	0.38	-0.04
	5030.57	8	4.08	3.29	0.24	0

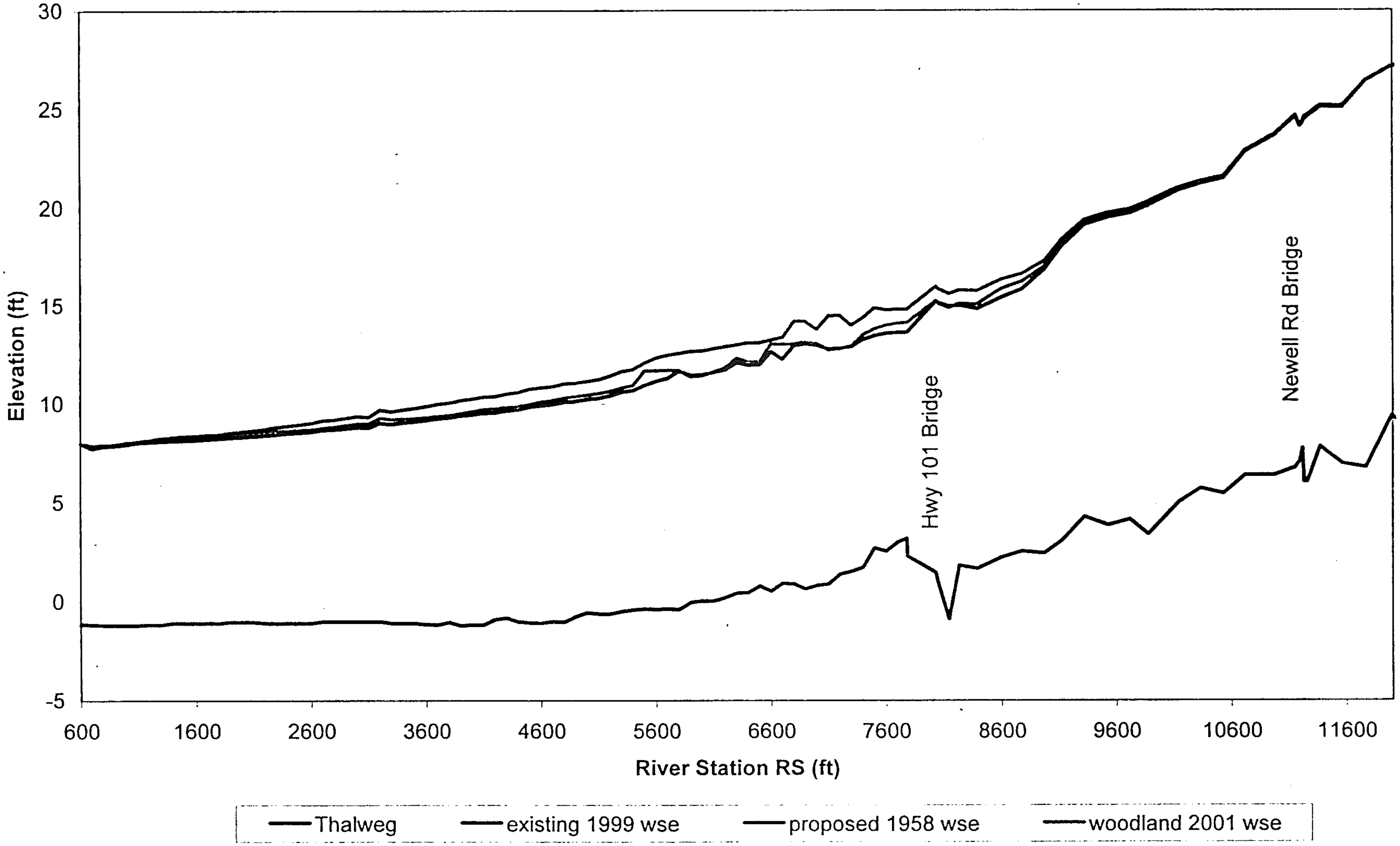
Existing 1999 Conditions (Q = 6,000 cfs)
with & without weir

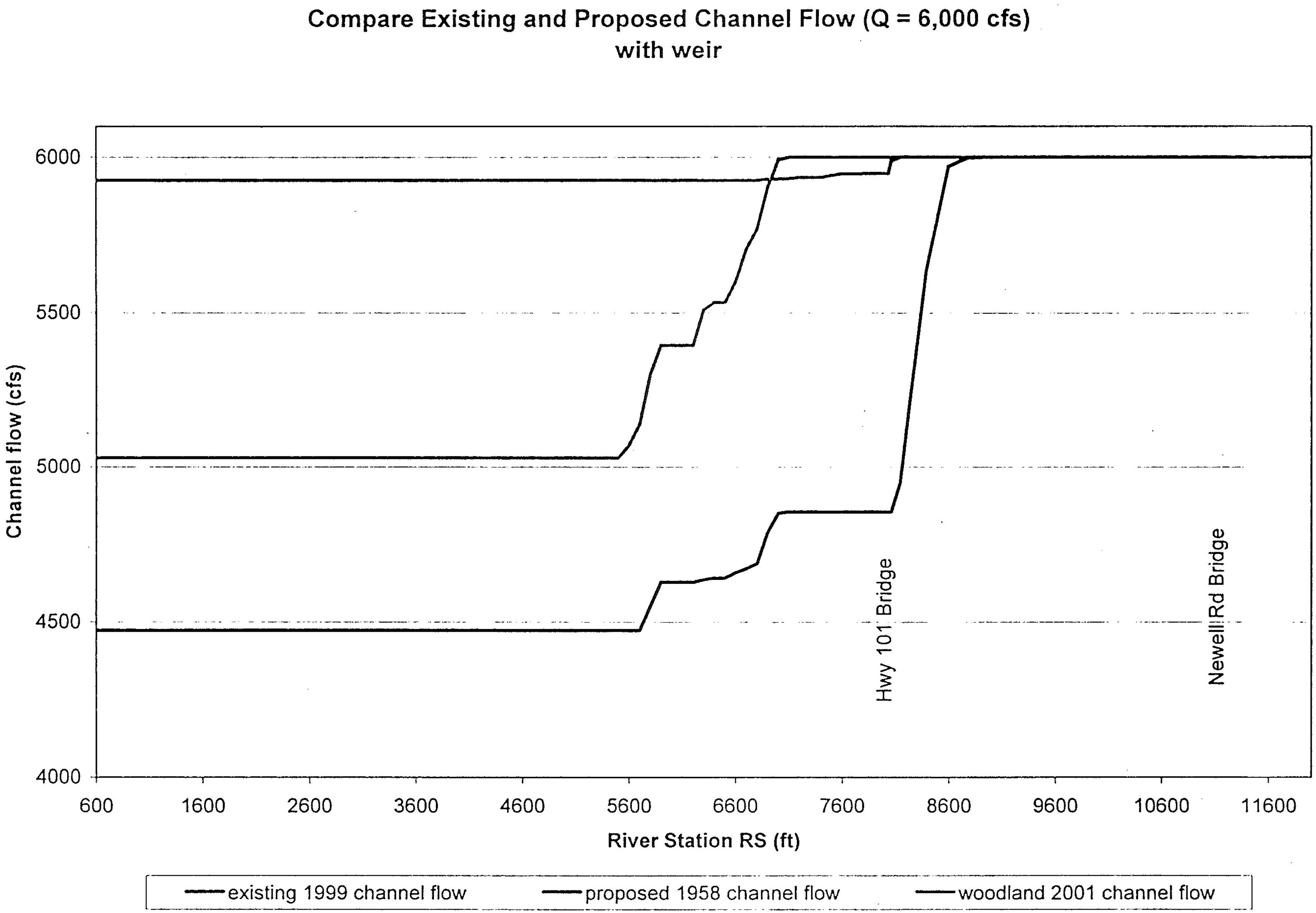



Proposed 1958 Conditions (Q = 6,000 cfs)
with & without weir
Elevation (ft)
30
25
20
15
10
5
0
-5
600
1600
2600
3600
4600
5600
6600
7600
8600
9600
10600
11600
River Station RS (ft)
Hwy 101 Bridge
Newell Rd Bridge
Thalweg
Left levee
Right Levee
wse (with weir)


Woodland 2001 Conditions (Q = 6,000 cfs)
with & without weir
Elevation (ft)
30
25
20
15
10
5
0
-5
600
1600
2600
3600
4600
5600
6600
7600
8600
9600
10600
11600
River Station RS (ft)
Hwy 101 Bridge
Newell Rd Bridge
Thalweg
Left levee
Right Levee
wse (with weir)
wse (no weir)

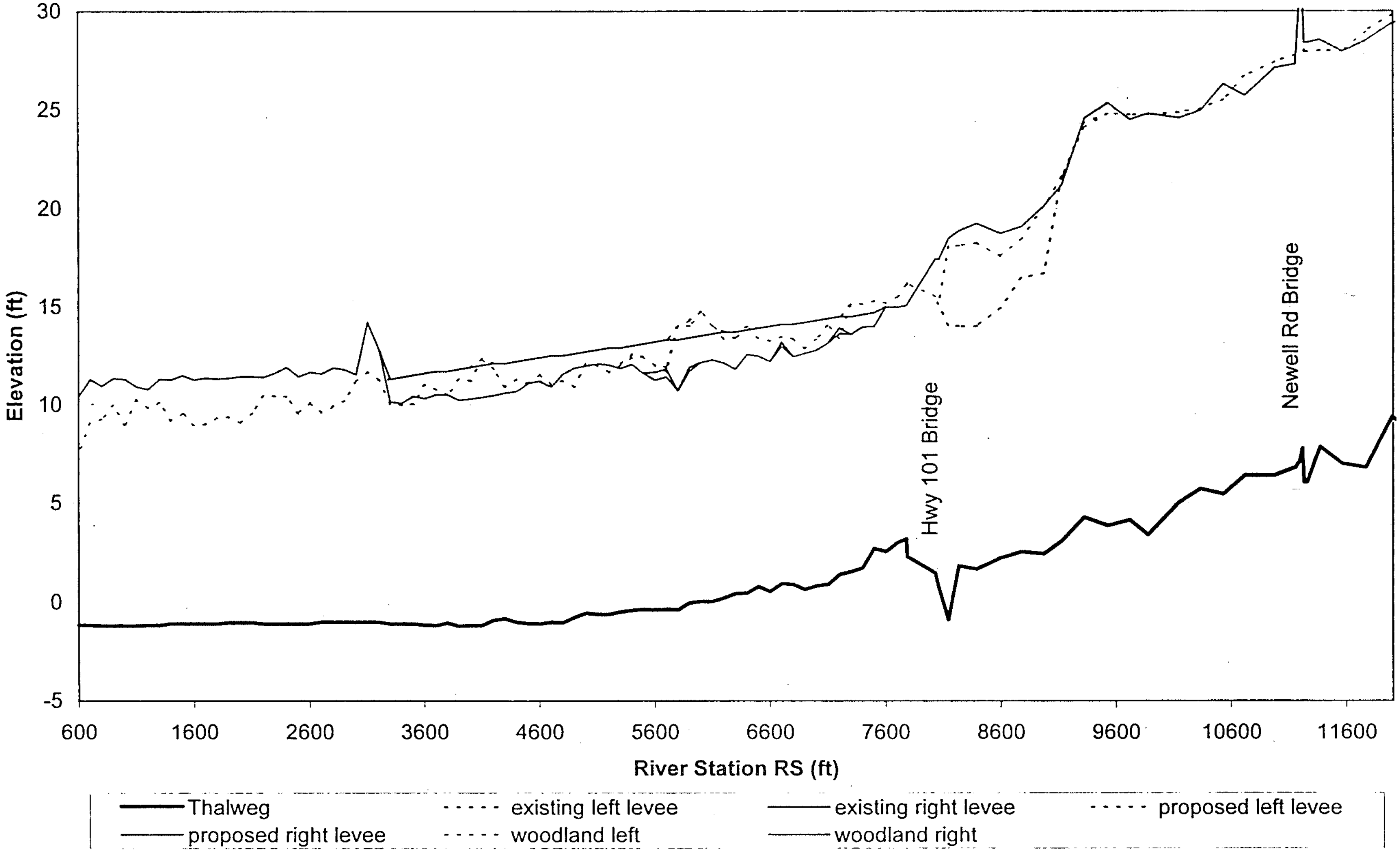
Compare Existing, Proposed, & Woodland Wse (Q = 6,000 cfs)
with weir





Compare Existing and Proposed Channel Flow (Q = 6,000 cfs)
with weir

Compare Existing and Proposed Levee Elevations



APPENDIX D

SAN FRANCISQUITO CREEK LEVEE PROJECT

Levee Maintenance Plan Guidelines

SAN FRANCISQUITO CREEK
LEVEE MAINTENANCE PLAN

These plans will be carried out as permitted by environmental codes and regulations.

Inspection shall be made before the flood season, after each major high water period, after each earthquake of greater than Richter 5.0, and in response to specific requests for maintenance service to ensure that the integrity of the levee system is not compromised. Inspections will include assessments for the following conditions, with corrective measures to be implemented as indicated below.

1. Unusual settlement, sloughing, or significant loss of grade of levees. In cases where the levee grade is found to have settled below the design elevations by six inches or more, the crown grade will be restored to the original design grade with appropriate materials. Service and levee roads are to be maintained in original condition.

2. Caving on either the landside or waterside of the levee that might affect the stability of the levee section will be corrected using appropriate methods and materials.

3. Seepage, saturated areas, or sand boils, if found, will be noted, monitored and corrected as appropriate.

4. Unauthorized vehicular traffic on the levee will not be permitted. If noted, preventive measures will be taken.

5. Encroachments on the levee rights-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency will not be permitted. If noted, corrective actions will be taken.

6. The outboard levee slopes will be selectively sprayed with pre- and post-emergent vegetation control products. Selective pruning of shrubbery and trees along the top or outboard slope of the levee may be performed to maintain access and levee stability.

7. Extermination measures will be taken if burrowing animals such as muskrats, ground hogs, ground squirrels, moles, and gophers are found in the levee.

8. Service roads will be maintained in such condition that they will be accessible at all times to all vehicles used in maintenance work or flood responses.

9. Potential bank erosion extending close to the toe of the levee along the low-flow channel will be monitored. Levee and bank erosion conditions will be periodically inspected and evaluated, and slope protection measures will be implemented as necessary.

APPENDIX E

SAN FRANCISQUITO CREEK LEVEE PROJECT

Hydraulic Impact Analysis for Alternative 6: Increase Levee Height to Less Than 1958 As-Built

SAN FRANCISQUITO CREEK: ALTERNATIVES TO RESTORING LEVEES TO 1958 ELEVATIONS

CRITERIA IS AMOUNT OF HEIGHT THAT CAN BE ADDED WITHOUT IMPACTING WATER SURFACE BY MORE THAN 0.2' **OR** INDUCING ADDITIONAL FLOODING

Option 1: Raise levees from downstream end of project toward upstream, to maximum extent possible.

EXISTING CONDITIONS, W/ OVERBANKING				1) Bring all EPA to '58 el (a)				2) all EPA to 1958 AND PA to '58 el from Sta 31+00 to Sta 60+00			
River Sta (ft)	Q in channel (cfs)	WSEL (ft)	Q out (cfs)	Q in channel	WSEL	Q out	Δ WSEL	Q in channel (cfs)	WSEL (ft)	Q out (cfs)	Δ WSEL (ft)
Newell Bridge				Bridge				Bridge			
11193	6000	24.18	0	6000	24.19	0	0.01	6000	24.19	0	0.01
11155.5	6000	24.66	0	6000	24.66	0	0	6000	24.66	0	0
10976	6000	23.72	0	6000	23.72	0	0	6000	23.72	0	0
10716	6000	22.89	0	6000	22.89	0	0	6000	22.89	0	0
10530	6000	21.58	0	6000	21.58	0	0	6000	21.58	0	0
10333	6000	21.31	0	6000	21.32	0	0.01	6000	21.31	0	0
10143	6000	20.97	0	6000	20.97	0	0	6000	20.97	0	0
9879	6000	20.23	0	6000	20.24	0	0.01	6000	20.24	0	0.01
9721	6000	19.85	0	6000	19.86	0	0.01	6000	19.86	0	0.01
9529	6000	19.66	0	6000	19.66	0	0	6000	19.66	0	0
9324	6000	19.29	0	6000	19.3	0	0.01	6000	19.3	0	0.01
9128	6000	18.25	0	6000	18.27	0	0.02	6000	18.26	0	0.01
8973	6000	17.01	0	6000	17.03	0	0.02	6000	17.03	0	0.02
8778	6000	16.24	0	6000	16.27	0	0.03	6000	16.26	0	0.02
8595	6000	15.86	0	6000	15.9	0	0.04	6000	15.89	0	0.03
8390	6000	15.06	0	6000	15.13	0	0.07	6000	15.11	0	0.05
8233	6000	15.08	0	6000	15.16	0	0.08	6000	15.14	0	0.06
8145.3	6000	14.84	0	6000	14.93	0	0.09	6000	14.9	0	0.06
8057.6	6000	15.11	0	6000	15.19	0	0.08	6000	15.17	0	0.06
8030	6000	15.25	0	6000	15.33	0	0.08	6000	15.31	0	0.06
Hwy 101 Bridge				Bridge				Bridge			
7787	6000	14.17	0	6000	14.24	0	0.07	6000	14.22	0	0.05
7779.3	6000	14.12	0	6000	14.2	0	0.08	6000	14.18	0	0.06
7700	6000	14.13	0	6000	14.2	0	0.07	6000	14.18	0	0.05
7600	6000	14.07	0	6000	14.15	0	0.08	6000	14.13	0	0.06
7500	6000	14.13	0	6000	14.21	0	0.08	6000	14.19	0	0.06
7400	5987.38	14.06	13	5972.15	14.15	28	0.09	5977.02	14.12	23	0.12
7300	5986.77	13.11	1	5968.83	13.23	3	0.12	5974.79	13.2	2	1.01
7200	5986.77	12.98	0	5968.83	13.1	0	0.12	5974.79	13.07	2	0.22
7100	5986.77	12.93	0	5968.22	13.24	1	0.31	5974.66	13.2	0	0.14
7000	5943.02	13.4	44	5897.82	13.41	70	0.01	5914.72	13.38	0	-0.2
6900	5765.63	13.39	177	5724.36	13.37	173	-0.02	5755.81	13.33	60	-0.01

EXISTING CONDITIONS, W/ OVERBANKING				1) Bring all EPA to '58 el (a)				2) all EPA to 1958 AND PA to '58 el from Sta 31+00 to Sta 60+00			
River Sta (ft)	Q in channel (cfs)	WSEL (ft)	Q out (cfs)	Q in channel	WSEL	Q out	Δ WSEL	Q in channel (cfs)	WSEL (ft)	Q out (cfs)	Δ WSEL (ft)
6800	5538.34	13.38	227	5500.33	13.33	224	-0.05	5550.89	13.29	159	-0.05
6700	5471.31	12.45	67	5437.71	12.44	63	-0.01	5498.11	12.35	53	0.75
6600	5426.59	12.95	45	5392.94	12.94	45	-0.01	5464.53	12.86	34	0.34
6500	5376.85	12.09	50	5342.94	12.09	50	0	5388.4	12.59	53	0.26
6400	5376.85	12.07	0	5342.94	12.07	0	0	5382.78	12 6	34	0.79
6300	5361.64	12.24	15	5327.92	12.23	15	-0.01	5306.9	12.52	76	0.35
6200	5265.64	11.77	96	5232.85	11.77	95	0	5066.43	12.47	6	0.83
6100	5265.64	11.62	0	5232.85	11.62	0	0	5049.5	12.12	76	0.9
6000	5265.64	11.44	0	5232.85	11.44	0	0	5049.5	12	0	1.16
5900	5265.64	11.4	0	5232.85	11.4	0	0	5049.5	11.97	0	1.07
5800	5174.97	11.69	91	5141.74	11.69	91	0	5049.5	11.87	17	0.43
5700	5011.72	11.72	163	4983.65	11.69	158	-0 03	5049.5	11.78	0	0.28
5600	4942.59	11.7	69	4921.69	11.68	62	-0.02	5049.5	11.63	0	0.27
5500	4899.1	11.69	43	4882.07	11.67	40	-0.02	5049.5	11.4	0	0.18
5400	4898.86	11	0	4881.94	10.98	0	-0.02	5049.5	11.1	0	0.78
5300	4898.86	10.92	0	4881.94	10.9	0	-0.02	5049.5	11.02	0	0.86
5200	4898.86	10.71	0	4881.94	10.7	0	-0.01	5049.5	10.81	0	0.92
5100	4898.86	10.58	0	4881.94	10.56	0	-0.02	5049.5	10.67	0	0.82
5000	4898.86	10.5	0	4881.94	10.49	0	-0.01	5049.5	10.59	0	0.6
4900	4898.86	10.41	0	4881.94	10.4	0	-0.01	5049.5	10.5	0	0.61
4800	4898.86	10.37	0	4881.94	10.36	0	-0.01	5049.5	10.46	0	0.44
4700	4898.86	10.24	0	4881.94	10.23	0	-0 01	5049.5	10.33	0	0.43
4600	4898.86	10.18	0	4881.94	10.17	0	-0.01	5049.5	10.27	0	0.41
4500	4898.86	10.11	0	4881.94	10.1	0	-0 01	5049.5	10 2	0	0.39
4400	4898.86	9.97	0	4881.94	9.96	0	-0.01	5049.5	10.05	0	0.49
4300	4898.86	9.9	0	4881.94	9.89	0	-0 01	5049.5	9.98	0	0.43
4200	4898.86	9 8	0	4881.94	9.79	0	-0.01	5049.5	9.88	0	0.47
4100	4898.86	9.77	0	4881.94	9.76	0	-0.01	5049.5	9.85	0	0.43
4000	4898.86	9.7	0	4881.94	9.69	0	-0.01	5049.5	9.77	0	0.35

Notes:

(a) Raised EPA side of levee to 1958 elevations.

FINDINGS 6000 cfs fully contained on EPA side

Increased water surface by less than 0.1 foot, all locations

= Area upstream of Hwy 101

= Areas where increase in WSEL is greater than 0.15' but less than 0.2'

▨ = Areas of concern where increase in WSEL is more than 0.2'

■ = Areas of concern where additional flooding (more than 15 cfs Qout additional) would be induced

3) all EPA to 1958 AND PA to '58 el from Sta 31+00 to Sta 60+00 AND PA by 0.5' from Sta 60+00 to Sta 70+00

Q in channel (cfs)	WSEL (ft)	Q out (cfs)	Δ WSEL (ft)
Bridge			
6000	24.19	0	0.01
6000	24.66	0	0
6000	23.72	0	0
6000	22.89	0	0
6000	21.58	0	0
6000	21.31	0	0
6000	20.97	0	0
6000	20.23	0	0
6000	19.86	0	0.01
6000	19.66	0	0
6000	19.3	0	0.01
6000	18.26	0	0.01
6000	17.03	0	0.02
6000	16.26	0	0.02
6000	15.89	0	0.03
6000	15.11	0	0.05
6000	15.13	0	0.05
6000	14.9	0	0.06
6000	15.16	0	0.05
6000	15.3	0	0.05
Bridge			
6000	14.22	0	0.05
6000	14.17	0	0.05
6000	14.17	0	0.04
6000	14.12	0	0.05
6000	13.95	0	-0.18
6000	13.64	0	-0.42
5999.97	13.61	0	0.5
5997.65	13.67	2	0.69
5974.11	13.44	24	0.51
5927.59	13.58	47	0.18
5861.96	13.54	66	0.15

4) all EPA to 1958 AND PA to '58 el from Sta 31+00 to Sta 60+00 AND PA by 0.5' from Sta 60+00 to Sta 76+00 (u/s of 76+00 PA is at '58)

Q in channel (cfs)	WSEL (ft)	Q out (cfs)	Δ WSEL (ft)
Bridge			
6000	24.2	0	0.02
6000	24.67	0	0.01
6000	23.73	0	0.01
6000	22.91	0	0.02
6000	21.61	0	0.03
6000	21.34	0	0.03
6000	21.01	0	0.04
6000	20.28	0	0.05
6000	19.91	0	0.06
6000	19.71	0	0.05
6000	19.36	0	0.07
6000	18.35	0	0.10
6000	17.17	0	0.16
6000	16.46	0	0.22
6000	16.13	0	0.27
6000	15.49	0	0.43
6000	15.52	0	0.44
6000	15.33	0	0.49
6000	15.56	0	0.45
6000	15.69	0	0.44
Bridge			
6000	14.57	0	0.40
6000	14.53	0	0.41
6000	14.54	0	0.41
6000	14.49	0	0.42
6000	14.35	0	0.22
6000	14.07	0	0.01
6000	13.63	0	0.52
6000	13.53	0	0.55
5999.71	13.71	0	0.78
5948.07	13.82	52	0.42
5808.88	13.79	139	0.40

5) all EPA to 1958 AND PA to '58 el from Sta 31+00 to Sta 60+00 AND PA by 0.5' from Sta 60+00 to Sta 70+00 AND raise PA low spots at 63+00 and 66+00 by additional 0.3'

Q in channel (cfs)	WSEL (ft)	Δ Q out (cfs)	Δ WSEL (ft)
Bridge			
6000	24.19	0	0.01
6000	24.66	0	0.00
6000	23.72	0	0.00
6000	22.89	0	0.00
6000	21.58	0	0.00
6000	21.32	0	0.01
6000	20.97	0	0.00
6000	20.24	0	0.01
6000	19.86	0	0.01
6000	19.66	0	0.00
6000	19.3	0	0.01
6000	18.27	0	0.02
6000	17.03	0	0.02
6000	16.27	0	0.03
6000	15.91	0	0.05
6000	15.14	0	0.08
6000	15.16	0	0.08
6000	14.93	0	0.09
6000	15.19	0	0.08
6000	15.33	0	0.08
Bridge			
6000	14.25	0	0.08
6000	14.2	0	0.08
6000	14.2	0	0.07
6000	14.15	0	0.08
6000	13.98	0	-0.15
6000	13.67	0	-0.39
5999.69	13.64	0	0.53
5993.39	13.7	6	0.72
5961.6	13.48	32	0.55
5904.24	13.62	57	0.22
5827.36	13.58	77	0.19

3) all EPA to 1958 AND PA to '58 el from Sta 31+00 to Sta 60+00 AND PA by 0.5' from Sta 60+00 to Sta 70+00

Q in channel (cfs)	WSEL (ft)	Q out (cfs)	Δ WSEL (ft)
5767.21	13.5	95	0.12
5728.63	13.46	39	1.01
5652.21	13.47	76	0.52
5593.77	12.71	58	0.62
5593.77	12.7	0	0.63
5558.07	12.89	36	0.65
5463.75	12.84	94	1.07
5458.97	12.45	5	0.83
5458.97	12.33	0	0.89
5458.97	12.3	0	0.9
5458.97	12.2	0	0.51
5458.97	12.11	0	0.39
5458.97	11.97	0	0.27
5458.97	11.72	0	0.03
5458.97	11.4	0	0.4
5458.97	11.32	0	0.4
5458.97	11.1	0	0.39
5458.97	10.94	0	0.36
5458.97	10.85	0	0.35
5458.97	10.76	0	0.35
5458.97	10.72	0	0.35
5458.97	10.58	0	0.34
5458.97	10.52	0	0.34
5458.97	10.45	0	0.34
5458.97	10.29	0	0.32
5458.97	10.22	0	0.32
5458.97	10.11	0	0.31
5458.97	10.08	0	0.31
5458.97	10	0	0.3

4) all EPA to 1958 AND PA to '58 el from Sta 31+00 to Sta 60+00 AND PA by 0.5' from Sta 60+00 to Sta 76+00 (u/s of 76+00 PA is at '58)

Q in channel (cfs)	WSEL (ft)	Q out (cfs)	Δ WSEL (ft)
5623.95	13.76	185	0.38
5577.13	12.96	47	0.51
5536.44	13.4	41	0.45
5488.08	12.66	48	0.57
5488.08	12.65	0	0.58
5462.49	12.83	26	0.59
5387.33	12.78	75	1.01
5385.15	12.39	2	0.77
5385.15	12.27	0	0.83
5385.15	12.25	0	0.85
5385.15	12.15	0	0.46
5385.15	12.06	0	0.34
5385.15	11.91	0	0.21
5385.15	11.67	0	-0.02
5385.15	11.35	0	0.35
5385.15	11.27	0	0.35
5385.15	11.05	0	0.34
5385.15	10.89	0	0.31
5385.15	10.8	0	0.30
5385.15	10.71	0	0.30
5385.15	10.67	0	0.30
5385.15	10.53	0	0.29
5385.15	10.47	0	0.29
5385.15	10.4	0	0.29
5385.15	10.25	0	0.28
5385.15	10.18	0	0.28
5385.15	10.07	0	0.27
5385.15	10.04	0	0.27
5385.15	9.96	0	0.26

5) all EPA to 1958 AND PA to '58 el from Sta 31+00 to Sta 60+00 AND PA by 0.5' from Sta 60+00 to Sta 70+00 AND raise PA low spots at 63+00 and 66+00 by additional 0.3'

Q in channel (cfs)	WSEL (ft)	Δ Q out (cfs)	Δ WSEL (ft)
5719.04	13.54	108	0.16
5670.66	13.51	48	1.06
5625.79	13.52	45	0.57
5595.25	12.77	31	0.68
5595.25	12.76	0	0.69
5580.86	12.95	14	0.71
5530.53	12.89	50	1.12
5522.29	12.49	8	0.87
5522.29	12.38	0	0.94
5522.29	12.35	0	0.95
5522.29	12.25	0	0.56
5522.29	12.16	0	0.44
5522.29	12.01	0	0.31
5522.29	11.77	0	0.08
5522.29	11.45	0	0.45
5522.29	11.36	0	0.44
5522.29	11.14	0	0.43
5522.29	10.98	0	0.40
5522.29	10.89	0	0.39
5522.29	10.8	0	0.39
5522.29	10.76	0	0.39
5522.29	10.62	0	0.38
5522.29	10.56	0	0.38
5522.29	10.49	0	0.38
5522.29	10.33	0	0.36
5522.29	10.26	0	0.36
5522.29	10.15	0	0.35
5522.29	10.12	0	0.35
5522.29	10.03	0	0.33

6) all EPA to 1958 AND PA '58 el to Sta 70+00

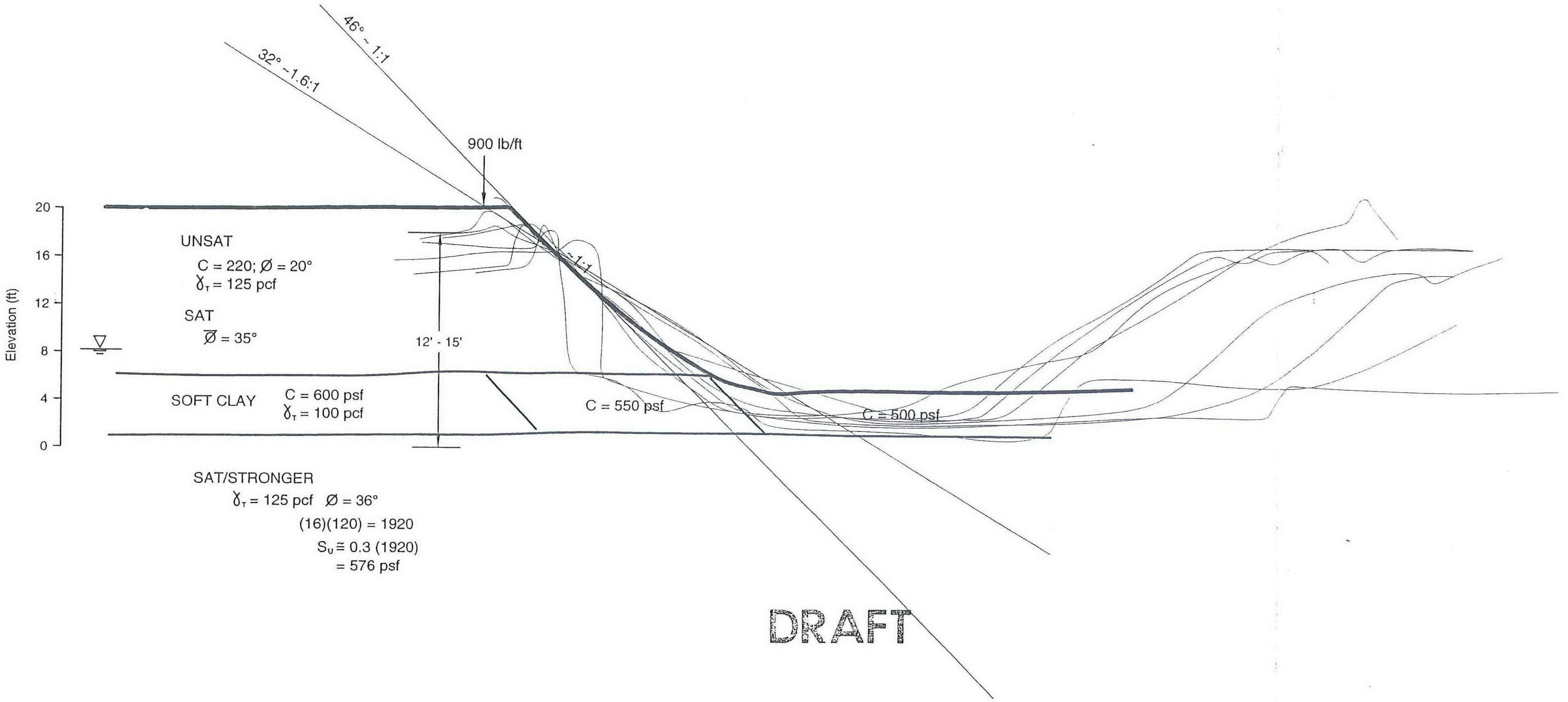
Q in channel (cfs)	WSEL (ft)	Δ Q out (cfs)	Δ WSEL (ft)
5368.47	13.33	0	-0.05
5368.47	12.94	0	0.49
5368.47	12.81	0	-0.14
5368.47	12.68	0	0.59
5368.47	12.67	0	0.60
5368.47	12.58	0	0.34
5368.47	12.48	0	0.71
5368.47	12.38	0	0.76
5368.47	12.26	0	0.82
5368.47	12.23	0	0.83
5368.47	12.13	0	0.44
5368.47	12.04	0	0.32
5368.47	11.89	0	0.19
5368.47	11.65	0	-0.04
5368.47	11.34	0	0.34
5368.47	11.26	0	0.34
5368.47	11.04	0	0.33
5368.47	10.88	0	0.30
5368.47	10.79	0	0.29
5368.47	10.7	0	0.29
5368.47	10 66	0	0.29
5368.47	10 52	0	0.28
5368.47	10.46	0	0.28
5368.47	10.39	0	0.28
5368.47	10.24	0	0.27
5368.47	10.17	0	0.27
5368.47	10.06	0	0.26
5368.47	10.03	0	0.26
5368.47	9.95	0	0.25

7) All EPA, plus raise PA 0.3' from Hwy 101 to Sta 70+00

Q in channel	WSEL	Q out	WSEL
5721.46	13.33	125	-0.05
5662.21	12.33	59	-0.12
5566.98	12.89	95	-0.06
5502.9	12.6	64	0.51
5502.9	12.12	0	0.05
5482.86	12.3	20	0.06
5381.6	12.21	101	0.44
5381.5	11.75	0	0.13
5381.5	11.58	0	0.14
5380.81	11.86	1	0.46
5259.75	11.9	121	0.21
5100.17	11.89	160	0.17
5004.68	11.88	95	0.18
4972.91	11.34	32	-0.35
4972.91	11.05	0	0.05
4972.91	10.97	0	0.05
4972.91	10.76	0	0.05
4972.91	10.62	0	0.04
4972.91	10.54	0	0.04
4972.91	10.46	0	0.05
4972.91	10.41	0	0 04
4972.91	10.28	0	0.04
4972.91	10.22	0	0.04
4972.91	10.15	0	0.04
4972.91	10.01	0	0.04
4972.91	9.94	0	0.04
4972.91	9.84	0	0.04
4972.91	9.81	0	0.04
4972.91	9.73	0	0 03

8) All EPA, plus raisePA 0.3' from Hwy 101 to Sta 70+00 PLUS raise PA gap at Sta 58+00 by 1.0'

Q in channel	WSEL	Q out	WSEL
5650.47	13.32	218	-0.06
5593.5	12.35	57	-0.1
5557.91	12.88	36	-0.07
5477.33	12.59	81	0.5
5476.33	12.12	1	0.05
5454.2	12.3	22	0.06
5300.71	12.22	153	0.45
5299.96	11.79	1	0.17
5299.96	11.63	0	0.19
5297.1	11.89	3	0.49
5267.91	11.93	29	0.24
5199.26	11.92	69	0.2
5063.22	11.92	136	0.22
5013.99	11.37	49	-0.32
5013.99	11 08	0	0.08
5013.99	11	0	0.08
5013.99	10.79	0	0.08
5013.99	10 65	0	0.07
5013.99	10.57	0	0.07
5013.99	10.48	0	0.07
5013.99	10.44	0	0.07
5013 99	10.3	0	0.06
5013.99	10.25	0	0.07
5013.99	10.18	0	0.07
5013.99	10.03	0	0.06
5013.99	9.96	0	0.06
5013.99	9.86	0	0.06
5013.99	9 83	0	0.06
5013.99	9.76	0	0.06



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CROSS SECTION

SAN FRANCISQUITO CREEK FLOODWALL
Palo Alto, California

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FIGURE _

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Table 7. Summary of Stability Analysis Results

Conditions	Factor of Safety	Comment
Existing condition	1.4	Satisfactory
Sudden drawdown	1.1	Satisfactory
Earthquake	1.2	PGA = 0.15g
	1.0	PGA = 0.25g
	< 1.0	PGA = 0.60g; 3-in to 1-foot of post EQ lateral displacement

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APPENDIX F

SAN FRANCISQUITO CREEK LEVEE PROJECT

Geotechnical Investigation
Draft dated March 15, 2002

LOWNEY ASSOCIATES
Environmental/Geotechnical/Engineering Services

Geotechnical Investigation
San Francisquito Creek Floodwall
Palo Alto, California

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Report No. 109-17 has been prepared for:

Santa Clara Valley Water District
San Jose, California

March 15, 2002

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APPENDIX B — LABORATORY PROGRAM
APPENDIX C — FLOODWALL ANALYSIS CALCULATIONS
APPENDIX D — CORROSIVITY EVALUATION

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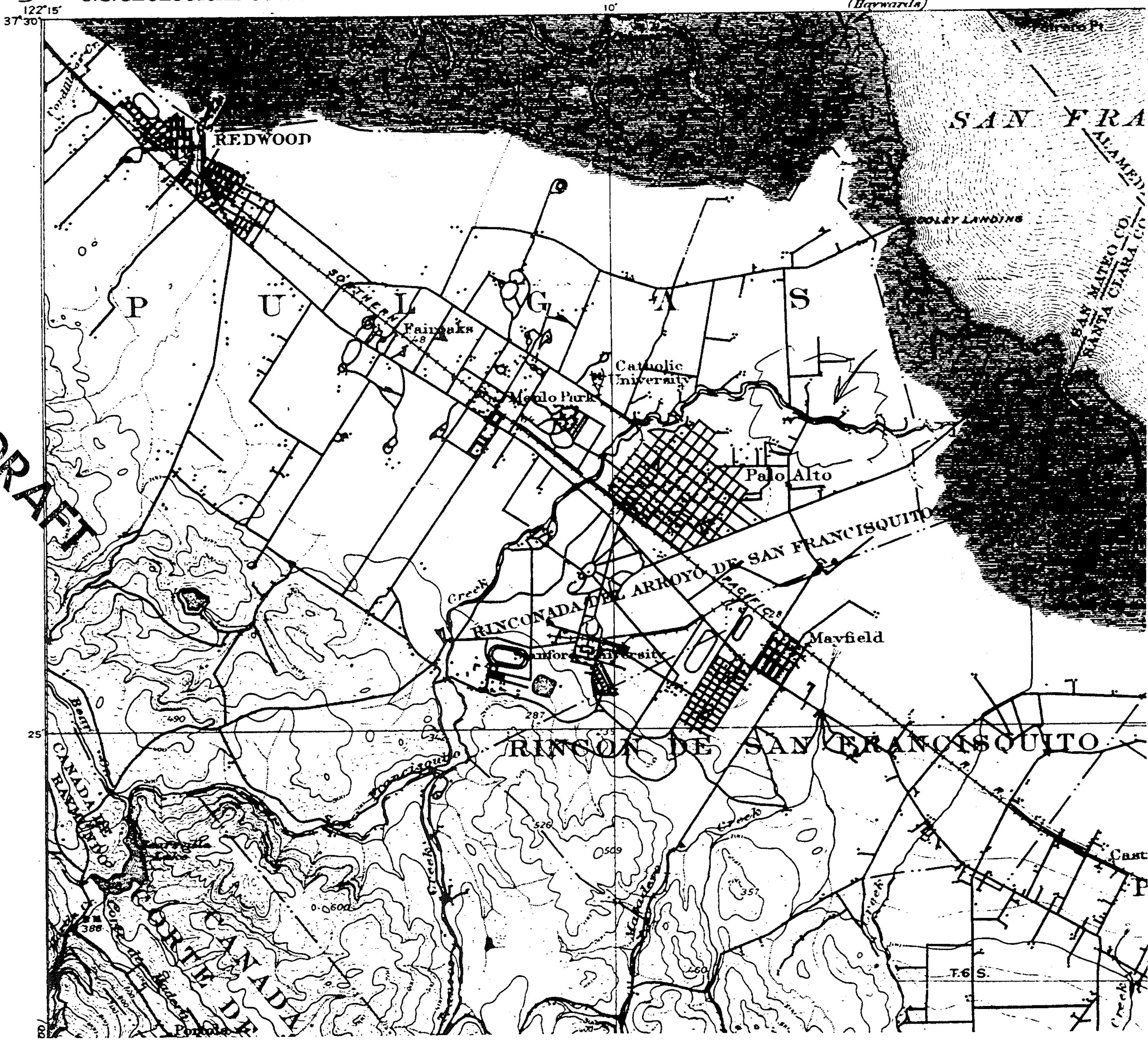
U.S. GEOLOGICAL SURVEY



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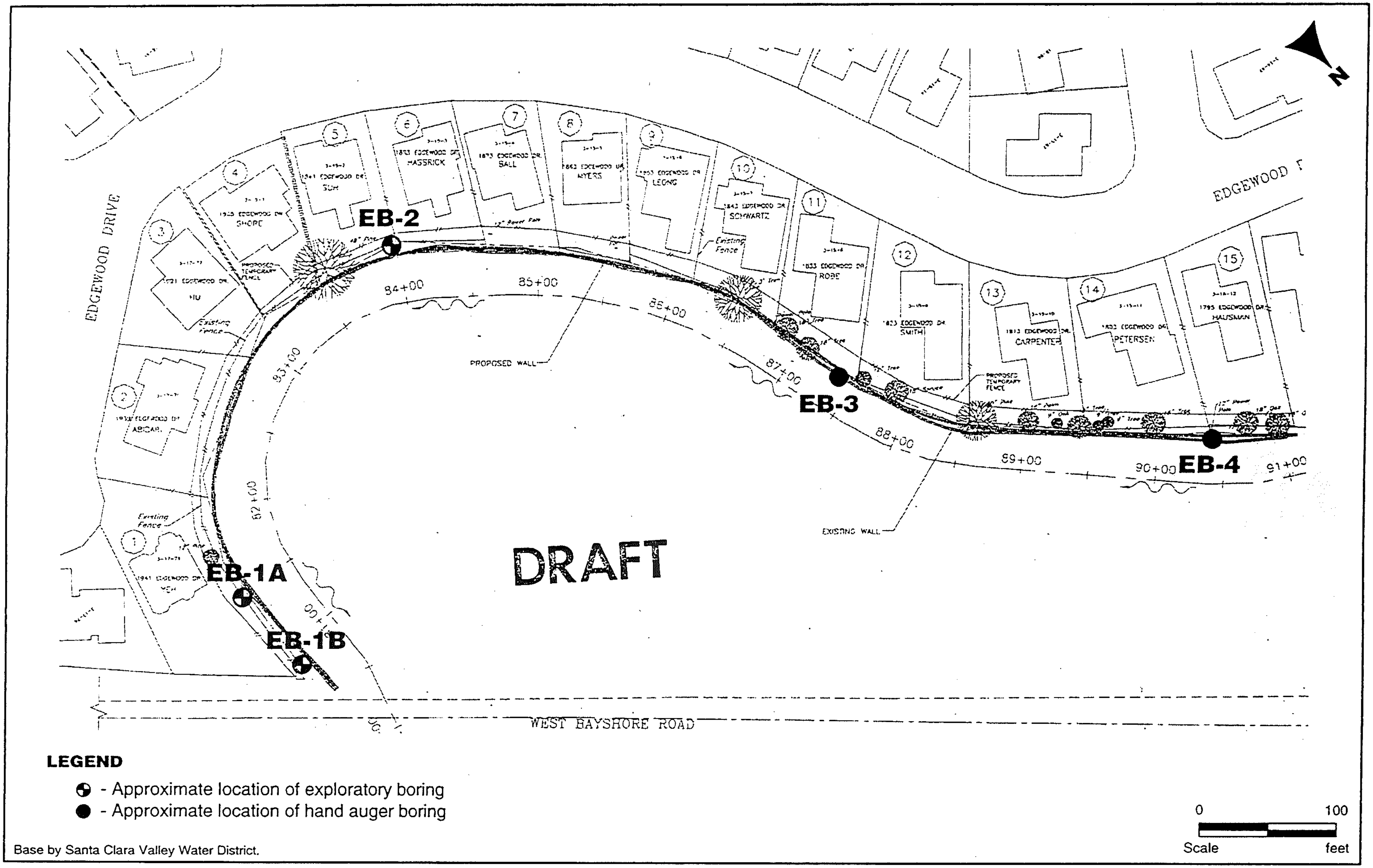

LEGEND

◐ - Approximate location of exploratory boring

● - Approximate location of hand auger boring

Base by Santa Clara Valley Water District.

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SITE PLAN

SAN FRANCISQUITO CREEK FLOODWALL
Palo Alto, California

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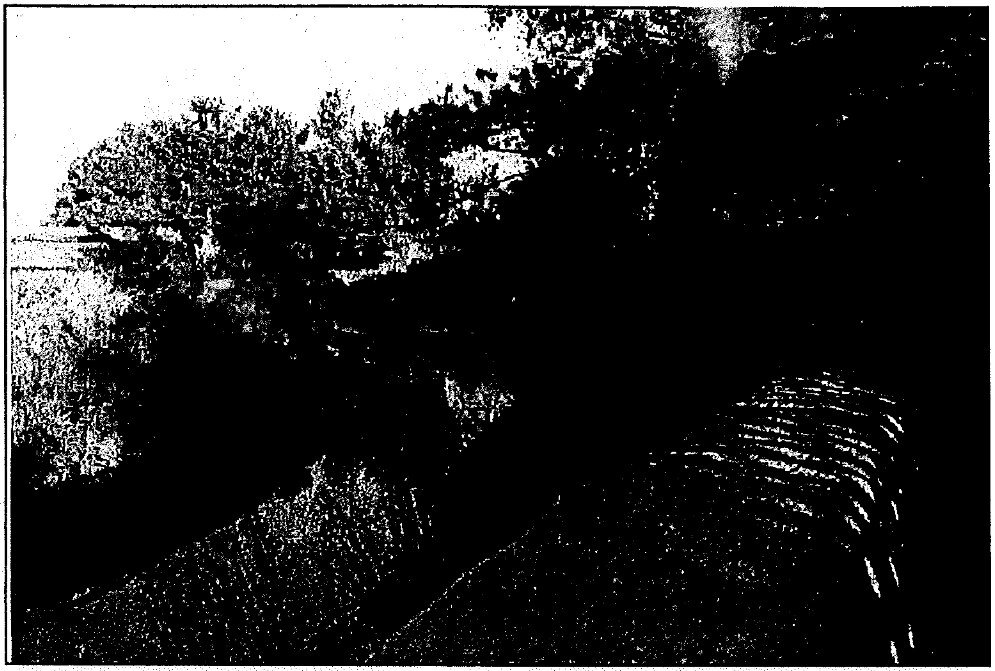
FIGURE 2
109-17



PHOTOGRAPH 1
View downstream from Sta. 84+00

PHOTOGRAPH 2
View upstream from about Sta. 85+00

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SITE PHOTOGRAPHS 1 AND 2

SAN FRANCISQUITO CREEK FLOODWALL
Palo Alto, California

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FIGURE 3
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Trees in bank

Large tree stump and other trees

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SITE PHOTOGRAPHS

SAN FRANCISQUITO CREEK FLOODWALL
Palo Alto, California

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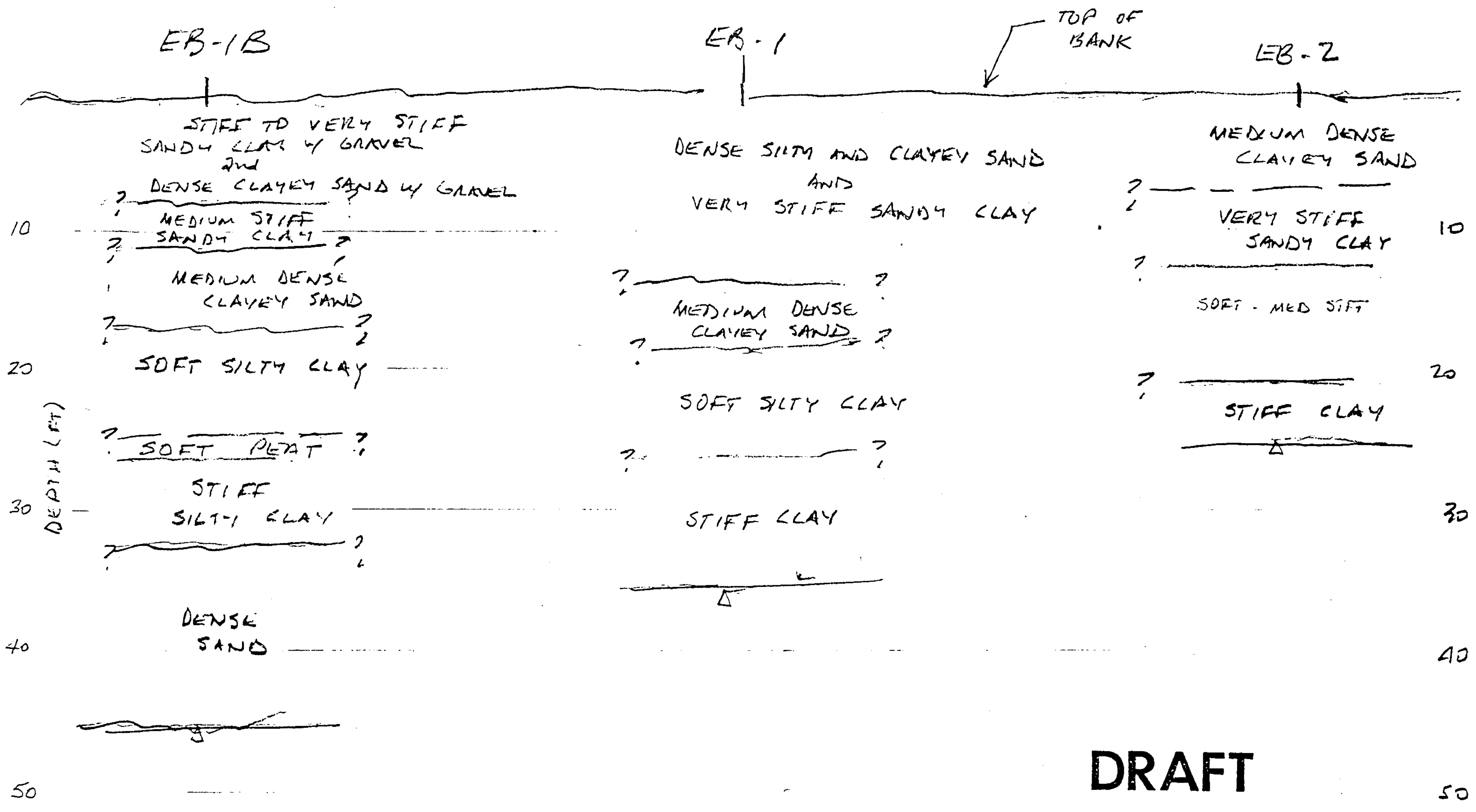
5
FIGURE ~~6~~
109-17


EB-1B
EB-1
EB-2
TOP OF BANK
STIFF TO VERY STIFF SANDY CLAY W/ GRAVEL and DENSE CLAYEY SAND W/ GRAVEL
MEDIUM STIFF SANDY CLAY
MEDIUM DENSE CLAYEY SAND
SOFT SILTY CLAY
SOFT PEAT
STIFF SILTY CLAY
DENSE SAND
DENSE SILTY AND CLAYEY SAND AND VERY STIFF SANDY CLAY
MEDIUM DENSE CLAYEY SAND
SOFT SILTY CLAY
STIFF CLAY
MEDIUM DENSE CLAYEY SAND
VERY STIFF SANDY CLAY
SOFT - MED STIFF
STIFF CLAY
?
10
20
30
40
50
DEPTH (FT)

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PRIMARY DIVISIONS			SOIL TYPE		SECONDARY DIVISIONS
COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS (Less than 5% Fines)	GW	●	Well graded gravels, gravel–sand mixtures, little or no fines
			GP	○	Poorly graded gravels or gravel–sand mixtures, little or no fines
		GRAVEL WITH FINES	GM	○	Silty gravels, gravel–sand–silt mixtures, plastic fines
			GC	▨	Clayey gravels, gravel–sand–clay mixtures, plastic fines
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS (Less than 5% Fines)	SW	░	Well graded sands, gravelly sands, little or no fines
			SP	░	Poorly graded sands or gravelly sands, little or no fines
		SANDS WITH FINES	SM	░	Silty sands, sand–silt–mixtures, non–plastic fines
			SC	▨	Clayey sands, sand–clay mixtures, plastic fines
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT IS LESS THAN 50 %		ML	▥	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL	▨	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	☰	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS LIQUID LIMIT IS GREATER THAN 50 %		MH	▥	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH	▨	Inorganic clays of high plasticity, fat clays
			OH	≋	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			PT	⁂	Peat and other highly organic soils

DEFINITION OF TERMS

U.S. STANDARD SIEVE SIZE — CLEAR SQUARE SIEVE OPENINGS

200 40 10 4 3/4" 3" 12"

SILTS AND CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

0.08 0.4 2 5 19 76mm

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GRAIN SIZES

☒	TERZAGHI SPLIT SPOON STANDARD PENETRATION
⧗	MODIFIED CALIFORNIA
▯	D&M UNDERWATER SAMPLER
■	SHELBY TUBE
○	NO RECOVERY

SAMPLERS

SAND AND GRAVEL	BLOWS/FOOT*
VERY LOOSE	0–4
LOOSE	4–10
MEDIUM DENSE	10–30
DENSE	30–50
VERY DENSE	OVER 50

RELATIVE DENSITY

SILTS AND CLAYS	STRENGTH+	BLOWS/FOOT*
VERY SOFT	0–1/4	0–2
SOFT	1/4–1/2	2–4
MEDIUM STIFF	1/2–1	4–8
STIFF	1–2	8–16
VERY STIFF	2–4	16–32
HARD	OVER 4	OVER 32

CONSISTENCY

*Number of blows of 140 pound hammer falling 30 inches to drive a 2–inch O.D. (1–3/8 inch I.D.) split spoon (ASTM D–1586).
+Unconfined compressive strength in tons/sq.ft. as determined by laboratory testing or approximated by the standard penetration test (ASTM D–1586), pocket penetrometer, torvane, or visual observation.

KEY TO EXPLORATORY BORING LOGS

Unified Soil Classification System (ASTM D–2487)

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FIGURE A–1

EXPLORATORY BORING: EB-1A

Sheet 1 of 2

DRILL RIG: FAILING 1500	PROJECT NO: 109-17
BORING TYPE: HOLLOW STEM	PROJECT: SAN FRANCISQUITO CREEK FLOODWALL
LOGGED BY: BAH	LOCATION: PALO ALTO, CA
START DATE: 2-15-02 FINISH DATE: 2-15-02	COMPLETION DEPTH: 35.5 FT.

This log is a part of a report by Lowney Associates, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

SURFACE ELEVATION:

MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
SANDY LEAN CLAY (CL) hard, moist, brown, fine to coarse sand, some fine to coarse gravel, low plasticity	CL				
CLAYEY SAND (SC) dense, moist, olive-brown, fine to coarse sand, some fine to coarse gravel	SC	57	7	122	
SILTY SAND (SM) dense, moist, brown to light brown, fine sand	SM	43	9	94	
		35	10		
SANDY LEAN CLAY (CL) very stiff, moist, brown, fine to medium sand, low plasticity	CL	12	25	89	
CLAYEY SAND (SC) medium dense, wet, brown, fine to medium sand	SC	20	24	98	
LEAN CLAY WITH SAND (CL) very stiff, moist, gray-brown, fine to medium sand, low plasticity	CL	9			
CLAYEY SAND (SC) medium dense, wet, brown, fine to medium sand	SC				
SILTY CLAY (CL-ML) [BAY MUD] soft, wet, gray, trace fine sand, low plasticity	CL-ML	4			
FAT CLAY (CH) stiff, moist, dark gray, some fine sand, high plasticity	CH	8	30	94	
LEAN CLAY (CL) stiff, moist, bluish-gray with orange mottles, some fine sand, low plasticity	CL	17	24	101	

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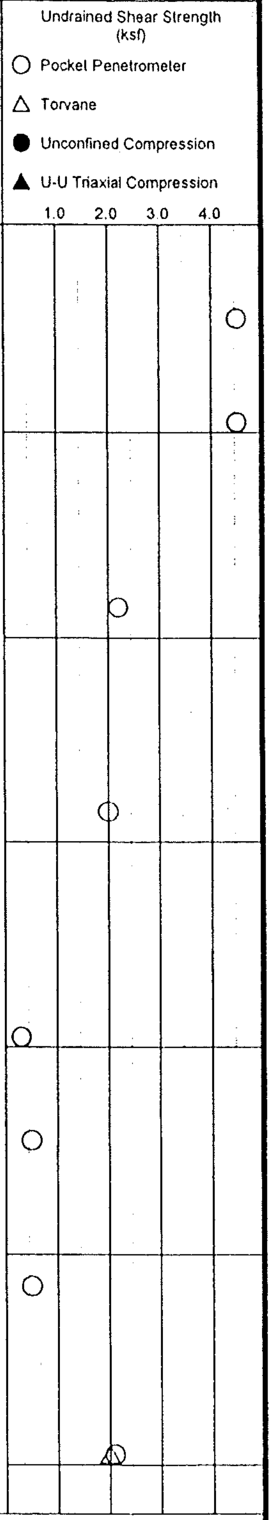

GROUND WATER OBSERVATIONS:

∇: FREE GROUND WATER MEASURED DURING DRILLING AT 12.0 FEET

LA CORP.GDT 3/13/02 MV" FLL

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EXPLORATORY BORING: EB-1A Cont'd

Sheet 2 of 2

DRILL RIG: FAILING 1500	PROJECT NO: 109-17
BORING TYPE: HOLLOW STEM	PROJECT: SAN FRANCISQUITO CREEK FLOODWALL
LOGGED BY: BAH	LOCATION: PALO ALTO, CA
START DATE: 2-15-02 FINISH DATE: 2-15-02	COMPLETION DEPTH: 35.5 FT.

This log is a part of a report by Lowney Associates, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

Undrained Shear Strength (ksf)

○ Pocket Penetrometer

△ Torvane

● Unconfined Compression

▲ U-U Triaxial Compression

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf) 1.0 2.0 3.0 4.0
	30	▨	**LEAN CLAY (CL)** stiff, moist, bluish-gray with orange mottles, some fine sand, low plasticity	CL		⧗				
		░	**POORLY GRADED SAND WITH SILT (SP-SM)** very loose, wet, gray-brown, medium to coarse sand, some fine sand, trace fine gravel	SP-SM	5	⧗				
	35									
			Bottom of Boring at 35½ feet							
	40									
	45									
	50									
	55									
	60									

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GROUND WATER OBSERVATIONS:

∇ : FREE GROUND WATER MEASURED DURING DRILLING AT 12.0 FEET

EXPLORATORY BORING: EB-1B

Sheet 1 of 2

DRILL RIG: FAILING 1500
BORING TYPE: ROTARY WASH
LOGGED BY: BAH
START DATE: 2-19-02 FINISH DATE: 2-19-02

PROJECT NO: 109-17
PROJECT: SAN FRANCISQUITO CREEK FLOODWALL
LOCATION: PALO ALTO, CA
COMPLETION DEPTH: 45.0 FT.

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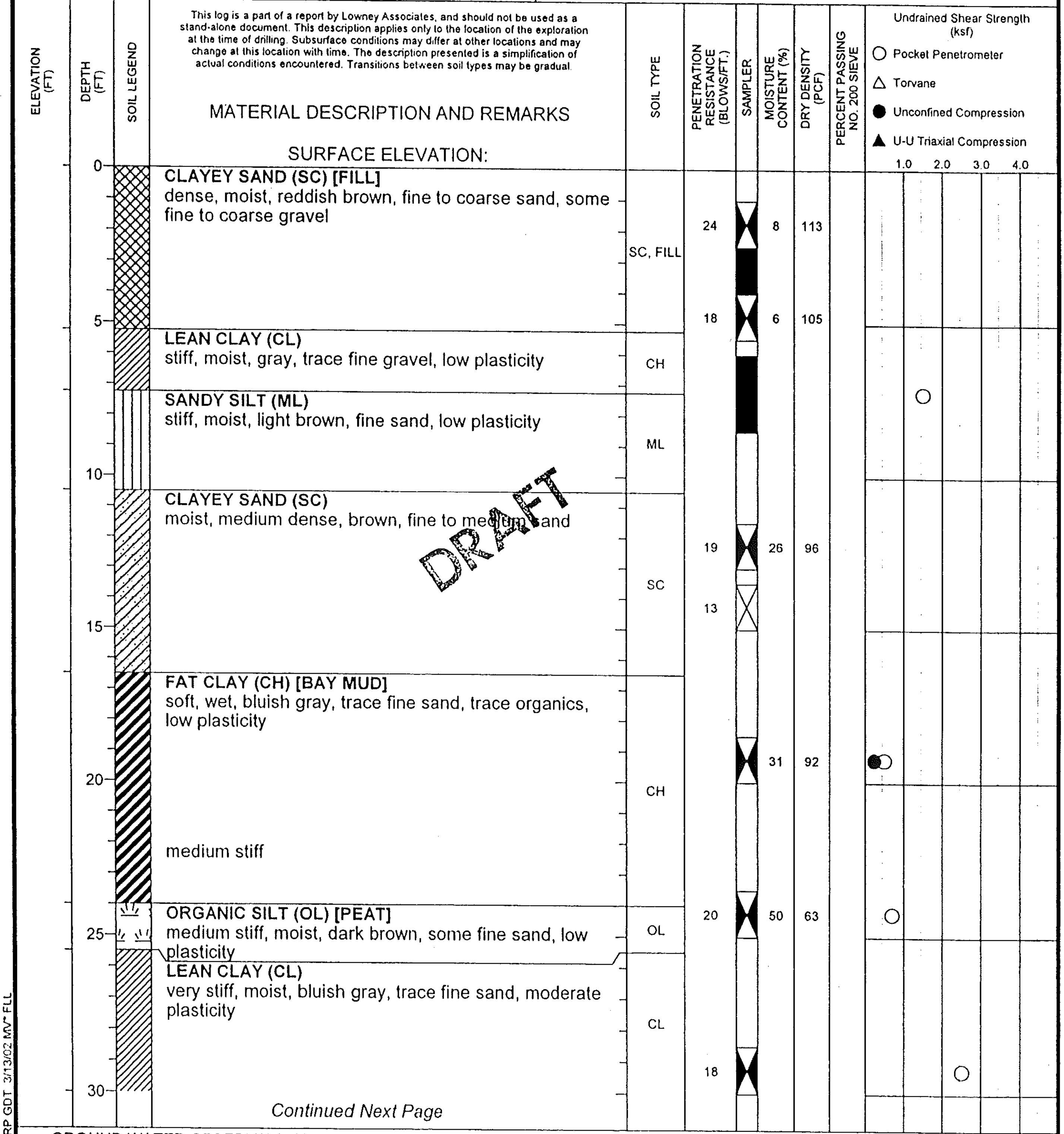

MATERIAL DESCRIPTION AND REMARKS

SURFACE ELEVATION:

MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
CLAYEY SAND (SC) [FILL] dense, moist, reddish brown, fine to coarse sand, some fine to coarse gravel	SC, FILL	24	8	113	
		18	6	105	
LEAN CLAY (CL) stiff, moist, gray, trace fine gravel, low plasticity	CH				
SANDY SILT (ML) stiff, moist, light brown, fine sand, low plasticity	ML				
CLAYEY SAND (SC) moist, medium dense, brown, fine to medium sand	SC	19	26	96	
		13			
FAT CLAY (CH) [BAY MUD] soft, wet, bluish gray, trace fine sand, trace organics, low plasticity	CH		31	92	
medium stiff					
ORGANIC SILT (OL) [PEAT] medium stiff, moist, dark brown, some fine sand, low plasticity	OL	20	50	63	
LEAN CLAY (CL) very stiff, moist, bluish gray, trace fine sand, moderate plasticity	CL	18			

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Continued Next Page

GROUND WATER OBSERVATIONS:
NOT APPLICABLE DUE TO ROTARY WASH CIRCULATION

LA CORP GDT 3/13/02 MV" FLL

EXPLORATORY BORING: EB-1B Cont'd

Sheet 2 of 2

DRILL RIG: FAILING 1500
BORING TYPE: ROTARY WASH
LOGGED BY: BAH
START DATE: 2-19-02 FINISH DATE: 2-19-02

PROJECT NO: 109-17
PROJECT: SAN FRANCISQUITO CREEK FLOODWALL
LOCATION: PALO ALTO, CA
COMPLETION DEPTH: 45.0 FT.

This log is a part of a report by Lowney Associates, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression
1.0 2.0 3.0 4.0

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf)
	30	▨	**LEAN CLAY (CL)** very stiff, moist, bluish gray, trace fine sand, moderate plasticity	CL						
		▒	**POORLY GRADED SAND WITH SILT (SP-SM)** dense, wet, gray-brown, medium to coarse sand, some fine sand, some fine to coarse gravel	SP-SM						
	35				31	☒	17			
					36	☒				
	40	▨	**CLAYEY SAND (SC)** wet, dense, brown, fine to coarse sand, some fine gravel	SC						
					31	☒	21			
	45		Bottom of Boring at 45 feet							
	50									
	55									
	60									

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GROUND WATER OBSERVATIONS:
NOT APPLICABLE DUE TO ROTARY WASH CIRCULATION

LA CORP GDT 3/13/02 MV' FLL

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EXPLORATORY BORING: EB-2

Sheet 1 of 1

DRILL RIG: MINUTE MAN
BORING TYPE: 3½ INCH FLIGHT AUGER
LOGGED BY: MQL
START DATE: 2-20-02 FINISH DATE: 2-20-02

PROJECT NO: 109-17
PROJECT: SAN FRANCISQUITO CREEK FLOODWALL
LOCATION: PALO ALTO, CA
COMPLETION DEPTH: 25.0 FT.

This log is a part of a report by Lowney Associates, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

SURFACE ELEVATION:

Undrained Shear Strength (ksf): ○ Pocket Penetrometer; △ Torvane; ● Unconfined Compression; ▲ U-U Triaxial Compression

DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf) 1.0 2.0 3.0 4.0
0	**CLAYEY SAND (SC)** medium dense, moist, light gray-brown, medium to coarse sand, some fine gravel						
			25	8			
			22	7	135		
5		SC					
	some clayey sand layers		40	8	134		
10 ▽							
	SANDY LEAN CLAY (CL) soft, moist, gray-brown, some medium fine to coarse sand, trace fine gravel, low plasticity						
			8	29.	96		○
15		CL					
			11	36	83		○
20							
	FAT CLAY (CH) [BAY MUD] medium stiff, moist, gray, trace fine sand, low plasticity	CH					
			10	24	103		○
25	Bottom of Boring at 25						
30							

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GROUND WATER OBSERVATIONS:
▽ : FREE GROUND WATER MEASURED DURING DRILLING AT 11.0 FEET

LA_CORP.GDT 3/13/02 MV* FLL

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EXPLORATORY BORING: EB-3

Sheet 1 of 1

DRILL RIG:	PROJECT NO: 109-17
BORING TYPE: HAND AUGER	PROJECT: SAN FRANCISQUITO CREEK FLOODWALL
LOGGED BY: BAH	LOCATION: PALO ALTO, CA
START DATE: 2-26-02 FINISH DATE: 2-26-02	COMPLETION DEPTH: 3.0 FT.

This log is a part of a report by Lowney Associates, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS SURFACE ELEVATION:	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	1.0 2.0 3.0 4.0
	0	▨	**CLAYEY SAND (SC)** moist, black, fine sand, some organics	SC		⧗				
		▨	**LEAN SANDY CLAY (CL)** moist, brown, fine sand, trace organics, low plasticity	CL		⧗				
			Bottom of Boring at 3 feet							
	5									

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GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 3/14/02 MV* FLL

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EXPLORATORY BORING: EB-4

Sheet 1 of 1

DRILL RIG:	PROJECT NO: 109-17
BORING TYPE: HAND AUGER	PROJECT: SAN FRANCISQUITO CREEK FLOODWALL
LOGGED BY: BAH	LOCATION: PALO ALTO, CA
START DATE: 2-26-02 FINISH DATE: 2-26-02	COMPLETION DEPTH: 3.5 FT.

This log is a part of a report by Lowney Associates, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

Undrained Shear Strength (ksf)
- ○ Pocket Penetrometer
- △ Torvane
- ● Unconfined Compression
- ▲ U-U Triaxial Compression

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS SURFACE ELEVATION:	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf) 1.0 2.0 3.0 4.0
	0	▨	**LEAN SANDY CLAY (CL)** moist, brown, fine sand, some organics, low plasticity	CL						
		▨	**CLAYEY SAND (SC)** moist, brown, fine sand	SC						
			Bottom of Boring at 3½ feet							
	5									

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GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 3/14/02 MV* FLL

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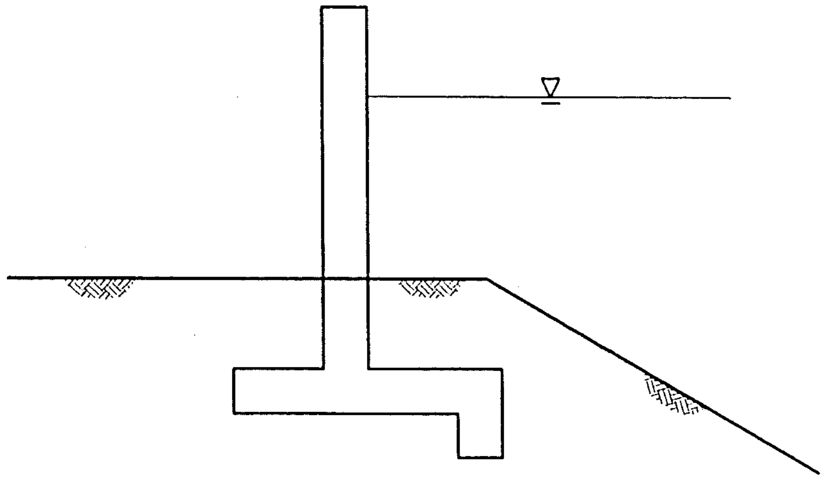
Table x – Soil Properties for Evaluation and Design

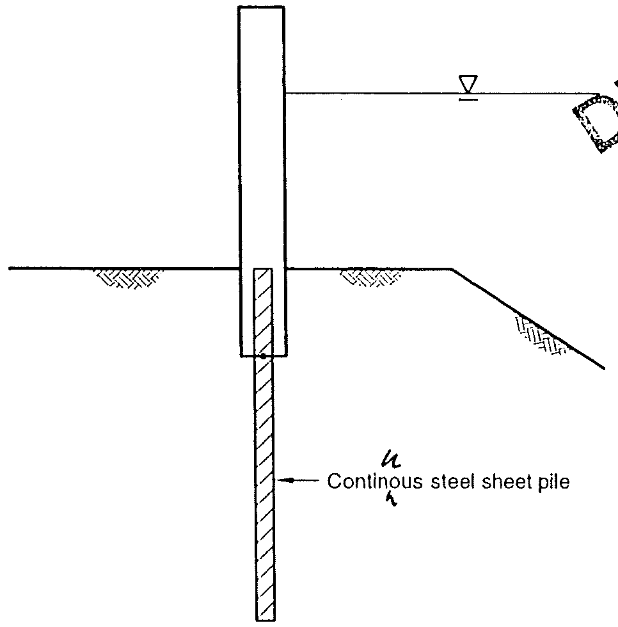
Soil Layer	Description	Dry Unit Weight (pcf)	Moisture content (%)	Shear Strength					Compressibility		
				Unsaturated (Total stress)		Saturated					
						Undrained	(Effective stress)				
				c (psf)	phi (degrees)	s_u (psf)	c′ (psf)	phi′ (degrees)	p_o' (ksf)	CR	RR
Upper soils	Stiff sandy clay and dense clayey sand	89-135	7-29	220	20	1,000	0	35	0.8-4.0	0.09-0.12	0.003-0.006
Bay mud soft clay	Soft to medium stiff silty clay, lean to fat clay	63-103	24-50	na	na	300-1,000	na	na	nt	nt	nt
Under soft clay	Stiff clay and dense sand	101	24	na	na	1,000	0	36	nt	nt	nt

Notes:

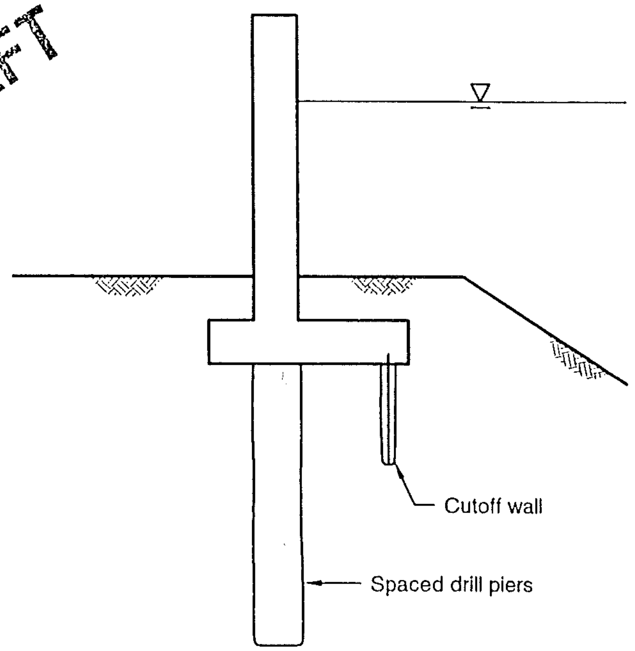
1. phi-friction angle; na-not applicable; nt-not tested.



COE INVERTED T FLOODWALL



SHEET PILE
SUPPORTED FLOODWALL



DRILLED PIER
SUPPORTED FLOODWALL

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302'EB

FLOODWALL ALTERNATIVES

SAN FRANCISQUITO CREEK FLOODWALL
Palo Alto, California

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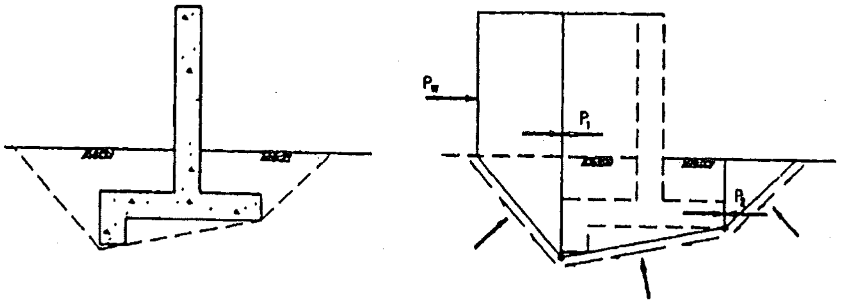
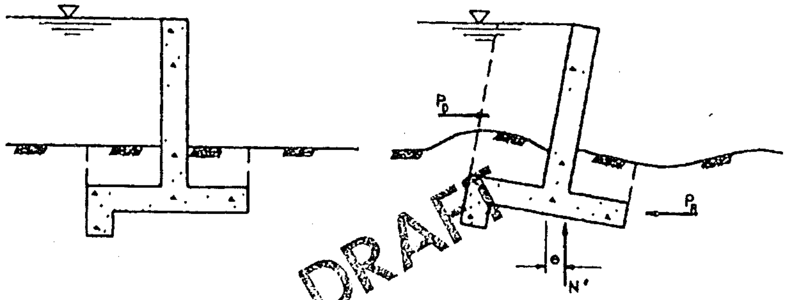
Environmental/Geotechnical/Engineering Services

FIGURE 7
109-17



$$\text{Factor of safety} = \frac{\text{Available shear resistance}}{\text{Shear required for equilibrium}}$$

a. Sliding



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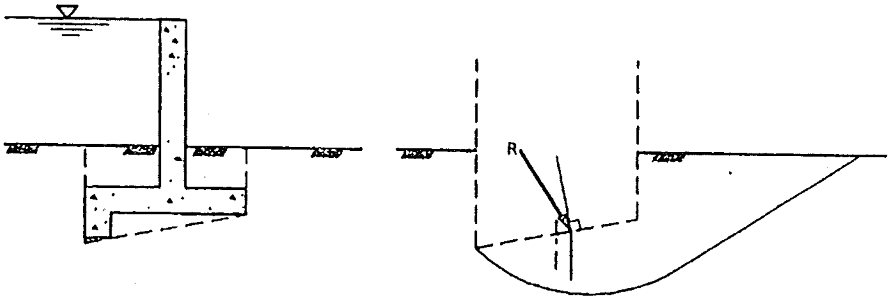
Safety assessed by checking base resultant location

b. Overturning



Use bearing theory for inclined, eccentric load, sloping base

c. Bearing

Ref: COE (1989)

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STABILITY ANALYSIS CONDITIONS INVERTED T FLOODWALL

SAN FRANCISQUITO CREEK FLOODWALL
Palo Alto, California

LOWNEYASSOCIATES
Environmental/Geotechnical/Engineering Services

FIGURE 8
109-17

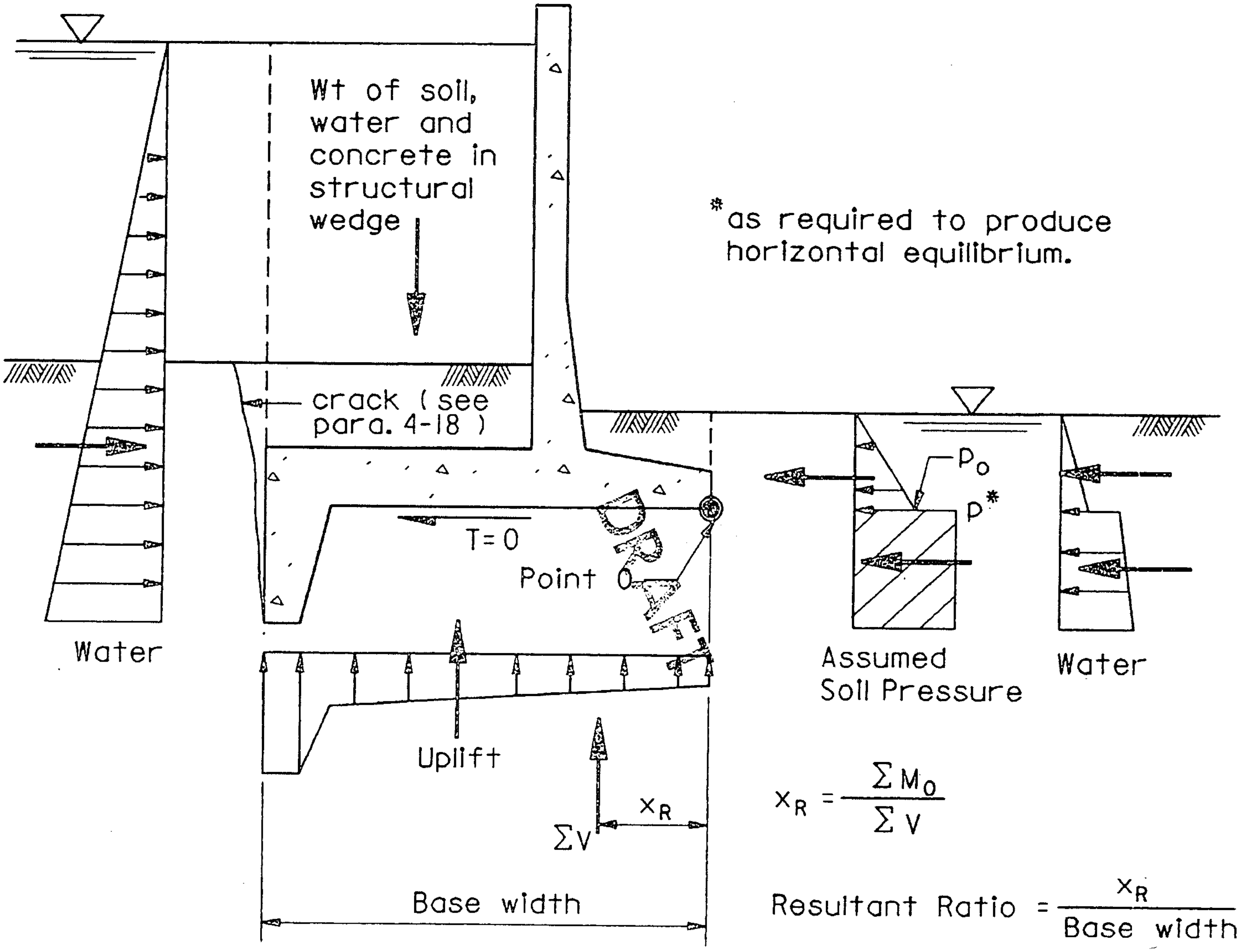
Wt of soil, water and concrete in structural wedge
*as required to produce horizontal equilibrium.
crack (see para. 4-18)
T=0
Point O
Water
Po
P*
Assumed Soil Pressure
Water
Uplift
ΣV
xR
Base width
xR = ΣMo / ΣV
Resultant Ratio = xR / Base width

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Figure 4-5. Forces for overturning analysis for wall with horizontal base and key

Table 4-2

Inland Flood Wall Stability Criteria

			Shear Strength Test Required		Overturning Criteria Minimum Base Area in Compression		
Case No.	Loading Condition	Sliding Factor of Safety, FS	Soil Foundation	Rock Foundation[3]	Soil Foundation	Rock Foundation	Minimum Bearing Capacity Safety Factor
I1	Design flood	1.5	(Q &/or S)[1]	Direct shear	100%[4]	75%[4]	3.0
I2	Water to top of wall	1.33	(Q &/or S)[1]	Direct shear	75%[4]	50%[4]	2.0
I3	Earthquake	1.1	(Q)	Direct shear	Resultant within base	Resultant within base	>1.0
I4	Construction	1.33	(Q &/or S)[2]	Direct shear	75%[4]	50%[4]	2.0

Notes

1. For soil foundations which are not free draining (permeability $< 10 \times 10^{-4}$ cm/sec), analyze for both Q and S strengths and design for the worst condition. For free-draining soil foundations (permeability $> 10 \times 10^{-4}$ cm/sec), analyze for S strengths only.

2. For construction loading cases, use Q strengths when excess pore water pressure in the soil foundation is anticipated and S strengths when it is not anticipated.

3. The sliding analysis of a wall on rock should be based on the frictional resistance (tan ϕ) of concrete on rock or rock on rock. The values should be obtained from direct shear tests of pre-cut samples of concrete on rock and rock on rock, or direct shear tests of natural rock joints or bedding planes.

4. Less base area in compression than the minimum shown may be acceptable provided adequate safety against unacceptable differential settlement and bearing failure is obtained.

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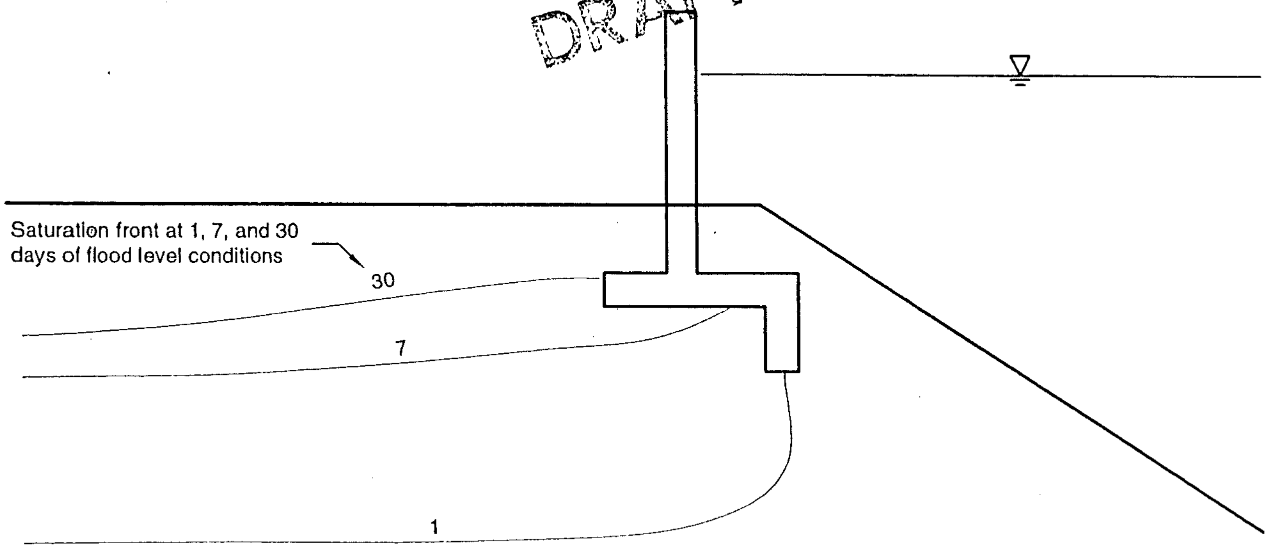
Saturation front at 1, 7, and 30 days of flood level conditions
30
7
1

TRANSIENT SEEPAGE CONDITION

3'02'EB

SEEPAGE CONDITIONS

SAN FRANCISQUITO CREEK FLOODWALL
Palo Alto, California

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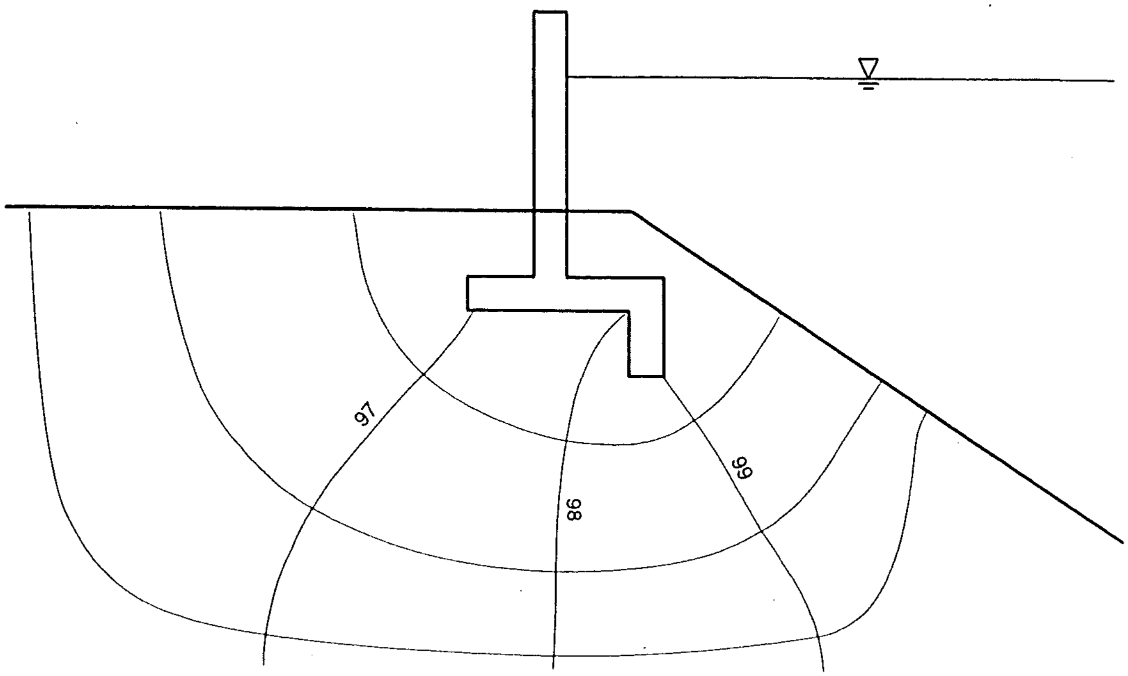
FIGURE ~~11~~ 10
109-17



STEADY STATE SEEPAGE CONDITION

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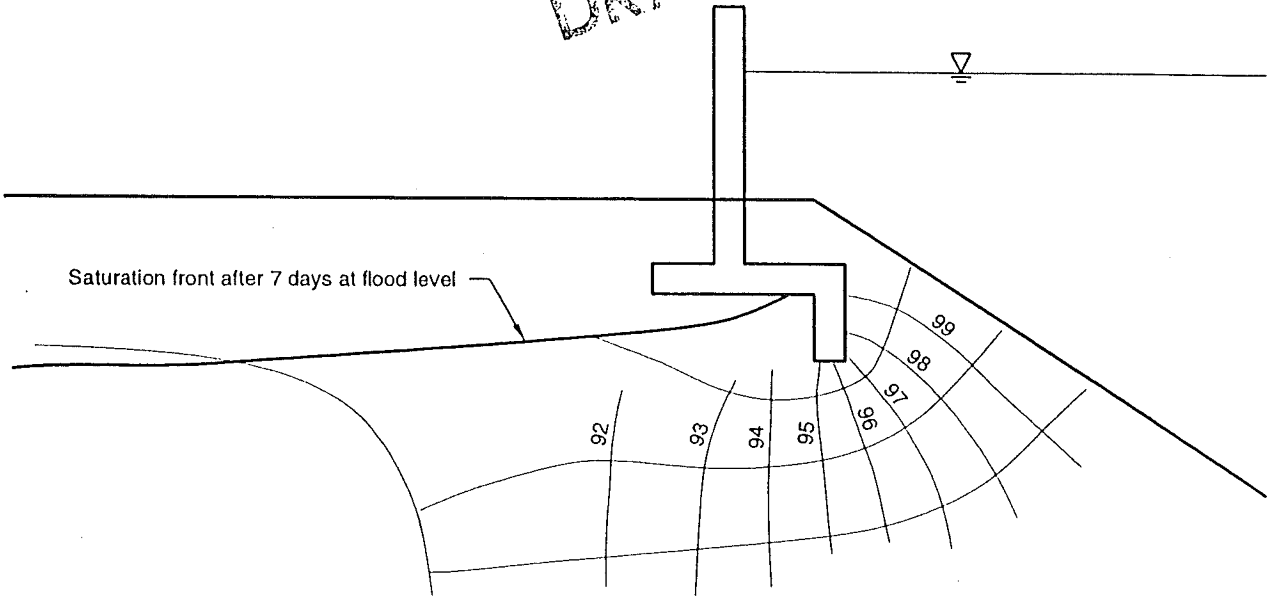

INTERMEDIATE SEEPAGE CONDITION

SEEPAGE CONDITIONS

SAN FRANCISQUITO CREEK FLOODWALL
Palo Alto, California

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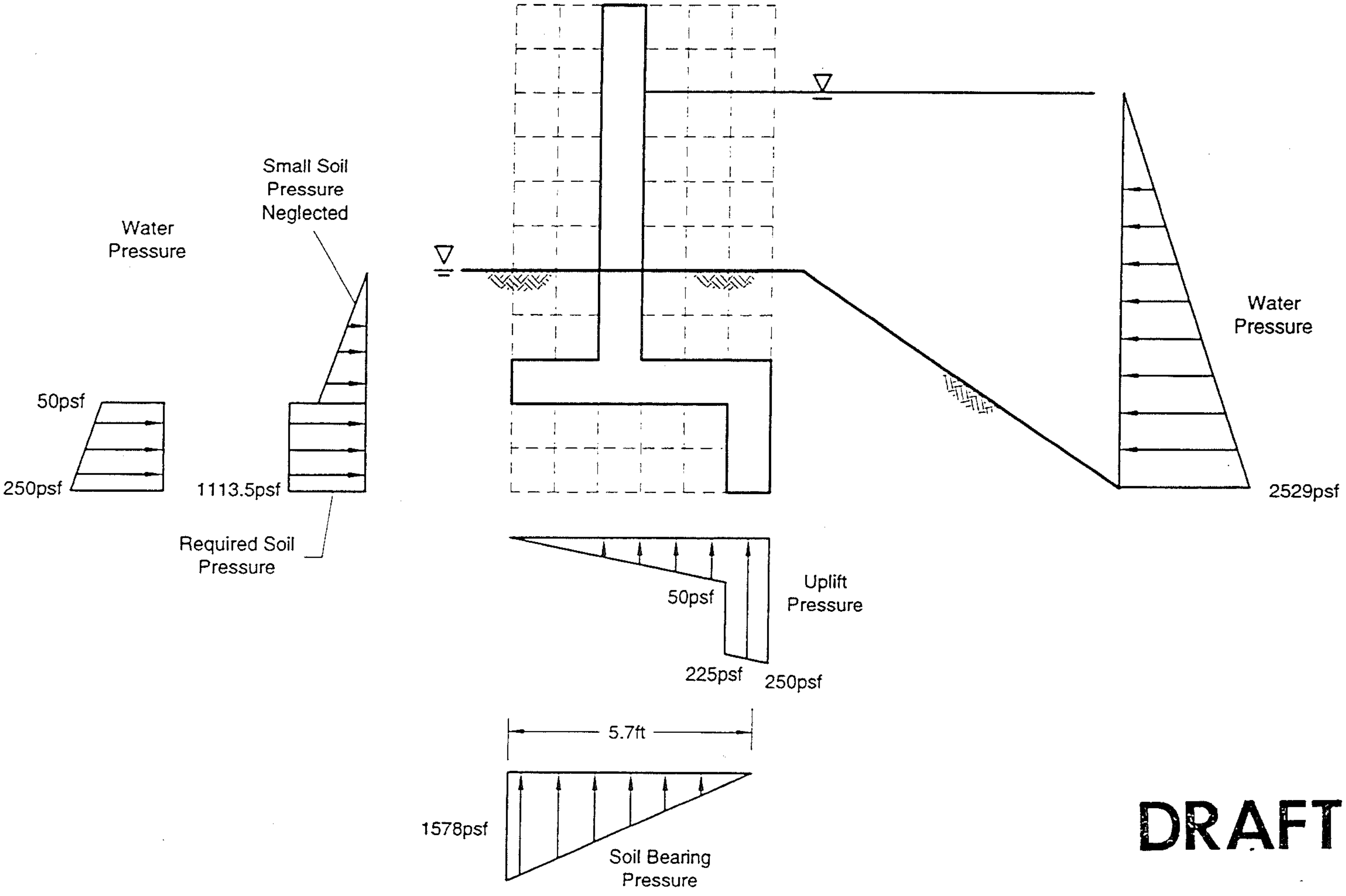
FIGURE ~~10~~ 11
109-17



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6-FEET HIGH INVERTED T FLOODWALL (INTERMEDIATE SEEPAGE, 7 DAY FLODD)

SAN FRANCISQUITO CREEK FLOODWALL
Palo Alto, California

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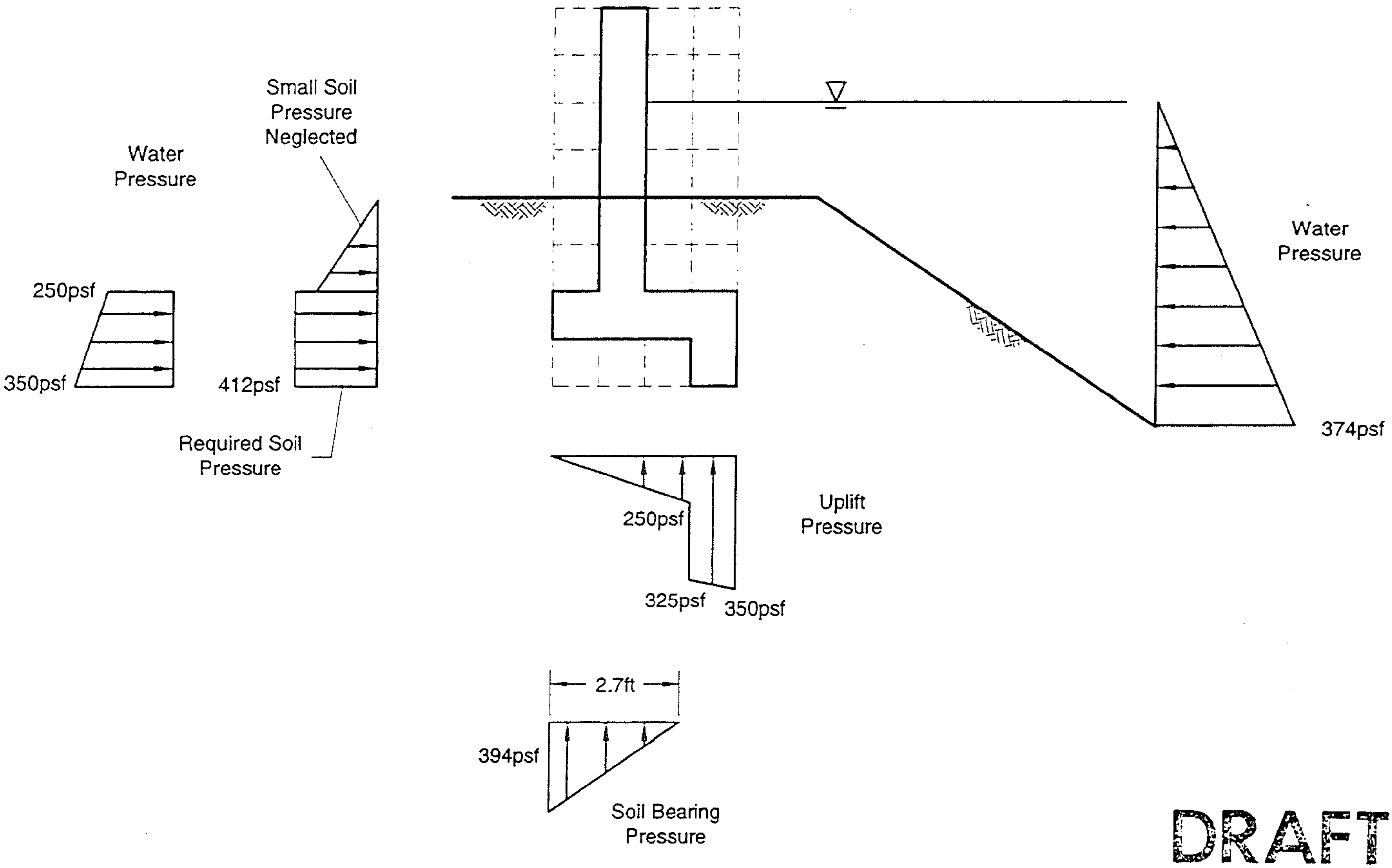
FIGURE 12C
109-17



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3/02~EB

4-FEET HIGH INVERTED T FLOODWALL (INTERMEDIATE SEEPAGE, 7 DAY FLOOD)

SAN FRANCISQUITO CREEK FLOODWALL
Palo Alto, California

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FIGURE 13B
109-17

Summary - Overturning, sliding and bearing capacity analyses
San Francisquito Creek Floodwall Project
109-17_FW_analysis02.xls

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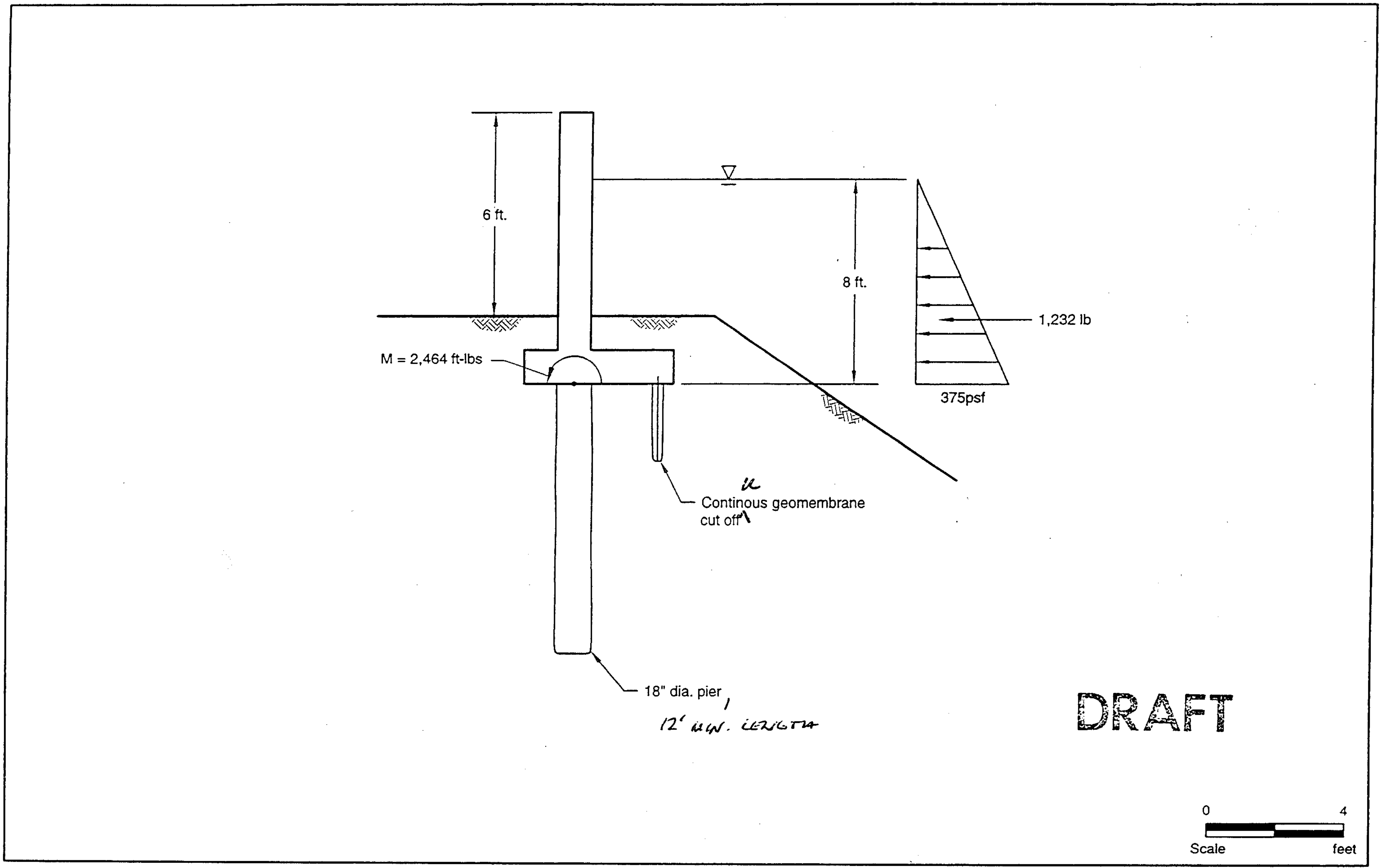
Ht. (ft)	Base (ft)	Seepage Condition	Stem Position (ft)	Xr (ft)	Result ratio	Max Press (psf)	Zero Press (ft)	c (psf)	phi (deg)	Sliding FS	percent of base engaged
6	5.5	Steady	2	0.9	0.16	1794	2.7	0	32	3.3	49%
								1000	0	13.9	
6	6	Steady	2	1.2	0.21	1146	3.7	0	32	3.4	62%
								1000	0	14.5	
6	6	1 day flood	2	2.1	0.35	1350	6	0	32	3.1	100%
								1000	0	6.4	
6	6	7 day flood	2	1.9	0.32	1399	5.7	0	32	3.3	95%
								1000	0	7.4	
6	7	Steady	2	1.9	0.27	875	5.6	0	32	3.7	80%
								1000	0	15.8	
6	8	Steady	2	2.5	0.31	755	7.4	0	32	3.9	93%
								1000	0	17.3	
4	4	Steady	1	1.2	0.29	828	3.5	0	32	14.2	88%
								1000	0	62.3	
4	4	1 day flood	1	1.4	0.34	1250	4	0	32	3.9	100%
								1000	0	9.3	
4	4	7 day flood	1	0.9	0.35	907	4	0	32	3.8	100%
								1000	0	12.2	
6	6	7 day high flood	2	1	0.16	2881	3	0	32	3.4	50%
								1000	0		
6	6.5	7 day high flood	2	1.4	0.22	2186	4.2	0	32	3.6	65%
								1000	0		
6	7	7 day high flood	2	1.8	0.26	1838	5.4	0	32	3.9	77%
								1000	0		



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3/02*EB

6-FEET HIGH DRILLED PIER SUPPORTED FLOODWALL

SAN FRANCISQUITO CREEK FLOODWALL
Palo Alto, California

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FIGURE 15
109-17

APPENDIX G

SAN FRANCISQUITO CREEK LEVEE PROJECT

Structural Evaluation of Sack Concrete Wall

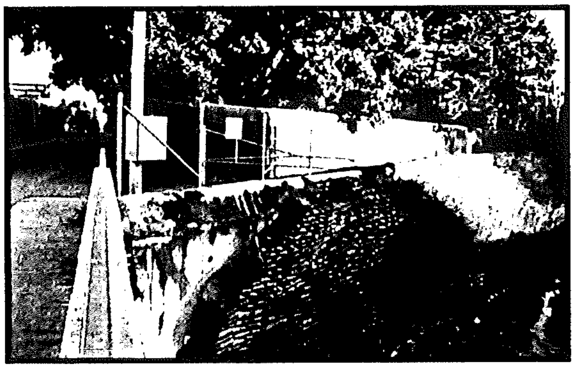
EVALUATION REPORT
San Francisquito Creek
Sack Concrete Wall

In
The City of Palo Alto

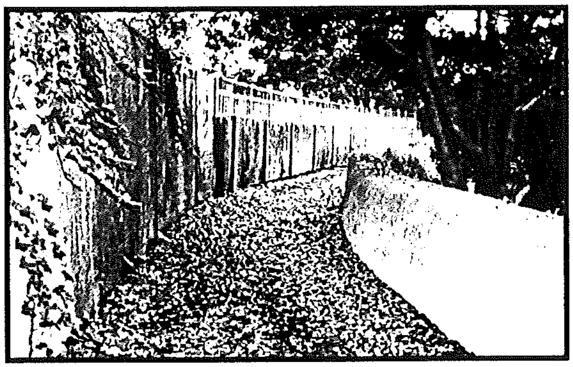
Introduction:

This Evaluation Report is prepared for Santa Clara Valley Water District to evaluate an existing sack concrete wall at San Francisquito Creek in the City of Palo Alto.

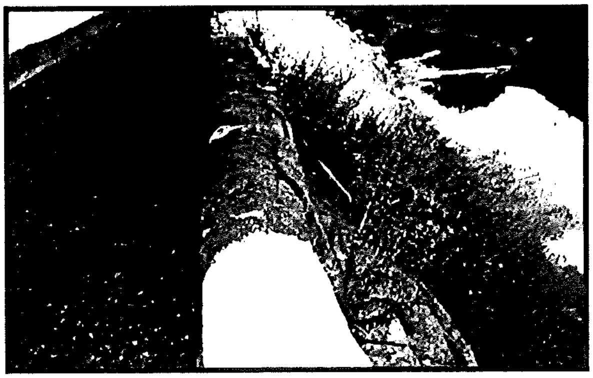
Photos of Existing Sack Concrete Wall:



Wall Front View



Wall Back View



Wall Top View -Damaged Shotcrete

Description:

The existing sack concrete wall is located on a curved alignment along the south side of San Francisquito Creek at W Bayshore Road in City of Palo Alto. The W Bayshore Road is located on the west side of Bayshore Freeway (Highway 101).

The existing wall was constructed by stacking concrete sacks together and forming a gravity type of floodwall. The wall height varies from 2 feet to 4 feet and has a width of 2 feet. The sack concrete wall is located on the top of the sack concrete channel lining along south side of San Francisquito Creek. 1 ½ inch thick shotcrete cover was applied on the sack concrete channel lining and the sack concrete wall to form a continuous surface.

Santa Clara Valley Water District plans to raise the wall height to meet current hydraulic requirements. It is proposed to raise the existing wall between 0.5' to 1.5' from station 81+00 to station 91+00.

Evaluation:

Mark Thomas Co. performed a field review of the wall and measured key dimensions on January 7, 2002. Design calculations were performed to evaluate the existing wall.

Findings:

Based on our inspection and calculations Mark Thomas Co. has reached the following conclusions:

1. The factor of safety[1] for sliding is 0.67 for existing wall. By raising the wall height 1-foot the factor of safety will be reduced to 0.53. The minimum factor of safety for walls of this type is 1.5. The factor of safety for sliding is below 1.5 for both existing wall and proposed raised wall.

2. The factor of safety of overturning is 1.44 for the existing wall. By raising the wall height 1-foot the factor of safety will be reduced to 0.92. The factor of safety for the raised wall is below the acceptable factor of safety of 1.5.

3. The existing wall was constructed without a continuous rigid foundation; additional load may cause uneven settlement. The uneven settlement may cause cracks on the shotcrete and weaken the sacked concrete wall. Cracked and damaged shotcrete was observed as shown on the photo above.

4. The sack concrete wall is not a monolithic structure and has no continuous horizontal steel reinforcement. This type of structure can easily disintegrate if the wall is overstressed.

---

1. Factor of safety is defined as the ratio of structure design capacity to loading demand.

Conclusions:

1. The existing wall does not meet minimum factor of safety for either sliding or overturning.
2. The construction details of the existing wall are not structurally sound and do not meet the FEMA design requirements.
3. Increasing the height of this already inadequate wall will result in an unsafe and unstable structure.

Prepared by:

Po Chen

Mark Thomas & Co.
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San Jose, Ca. 95112
(408) 453-5373